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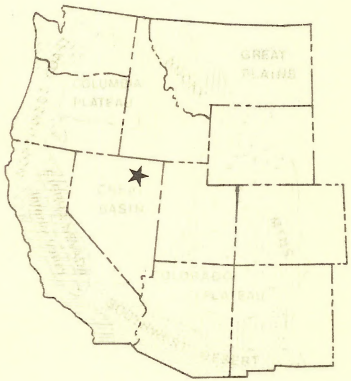
Saval Ranch Research and Evaluation Project



PROGRESS REPORT 1985

July 1986

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PROGRESS REPORT FOR 1985

SAVAL RANCH RESEARCH AND EVALUATION PROJECT

Editor

Peter C. Lent
Bureau of Land Management
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920 Valley Road
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HIGHLIGHTS

OF

1985

PUBLICATIONS AND PROFESSIONAL ACTIVIES	Three new publications are reported. Three others have been submitted and are in review or in press. Several professional presentations are also reported.
CLIMATOLOGY	Saval precipitation data are now available in a hard-copy format. Analysis of inter-station correlations has been completed and preliminary recommendations are made on stations to be dropped.
HYDROLOGY	Discharge data records for lower Gance and lower Mahala creeks are now completed and available.
VEGETATION	A multiple-year summary is provided for the vegetation monitoring efforts conducted from 1979 to 1985. Descriptions of the available data and summaries of information on livestock utilization appear in this annual report.
MULE DEER	The M.S. Thesis by Deborah Selby, "Diet Composition of Tamed Deer on the Saval Research and Evaluation Project," has been completed and approved. Copies are available. A summary is included in Chapter 5. The two-year study by Thomas Morrell, "Influence of Cattle Grazing on Mule Deer Diets and Habitat in Aspen Communities of Northeastern Nevada", has been completed and the thesis is in draft. A summary appears in Chapter 5.
NON GAME WILDLIFE	Five manuscripts for publications have been completed. Three are under revision after peer review. Two are in press.
FISHERIES	The Gance Creek trout population declined, as expected, in 1985. Numbers were relatively high at the ungrazed study site 2. Riparian streamside conditions continued to be marginal on the grazed areas following another year of heavy spring runoff.
LIVESTOCK	A presentation and publication is summarized comparing selenium in livestock from Saval with those from the Gund Ranch in north central Nevada. The Saval Ranch is in a zone of variable forage selenium levels. This is reflected in the plasma selenium levels which were generally lower than those from the Gund Ranch.
REMOTE SENSING	A five-year study has been completed comparing large scale aerial photography with conventional plant frequency data as monitoring tools. The results are being prepared for publication.

INTRODUCTION

The Saval Ranch Research and Evaluation Project was initiated in May, 1978. The overall objective is to evaluate the effects of livestock grazing management systems and range improvement practices on livestock production, vegetation, fish and wildlife and their habitat, watershed hydrology, water quality, economic factors, and other resource values.

The Project is conducted on the Saval Ranch, a privately owned enterprise located in northeastern Nevada. The ranch, livestock and grazing allotment are made available for this interdisciplinary study by the Saval Ranching Company. The allotment contains 49,105 acres; 7,557 acres are privately owned, 25,900 acres are managed by the Bureau of Land Management, and 15,600 acres are managed by the Forest Service.

Funding and support are provided by the Bureau of Land Management, U.S. Forest Service, Agricultural Research Service, and Agricultural Experiment Station, University of Nevada, Reno. Project direction is provided by an Executive Committee comprised of representatives of the supporting agencies and cooperators. Minutes of Executive Committee meetings held in 1985 appear in Appendix I.

In general, this progress report describes the project activities and results of scientific investigations for the period October 1, 1984 through September 30, 1985. In addition, some summaries and analyses of data collected in past years are included.

Generally, the common names of plants and animals are used in this report. Scientific names are given in Appendix II. The English system of measurement is also used. Factors to convert these measurements to metric units are presented in Appendix III.

The scientific results and conclusions reported here are to be considered unpublished and preliminary in nature. They are presented to meet contractual agreements and to provide the supporting agencies and parties with a basis for judging progress. No results should be cited or quoted without permission from the authors.

ACKNOWLEDGEMENTS

Once again Saval Project investigators received excellent assistance provided by Student Conservation Association volunteers. The 1985 volunteers, provided through an agreement between the Association and the Bureau of Land Management, were Chris Beach, Steve Biatowas, Krista Krayer and Dave Zuber. Former volunteer, Carole Hallett, returned as a summer employee.

PUBLICATIONS BASED IN PART

OR IN FULL ON SAVAL RANCH RROJECT

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Torell, L.A., E.B. Godfrey and R.E. Eckert Jr. 1985. Optimal livestock production on the Saval Ranch under season-long grazing and under the approved deferred/rest rotation grazing system. Univ. Nevada, Agric. Exp. Stat. Bull. TB5-85-1. 79p.

PROFESSIONAL ACTIVITIES OF PROJECT PERSONNEL

Gary Back, Richard E. Eckert Jr. and Peter Lent all gave presentations in the Range, Wildlife and Forestry Department's seminar series in Reno. R.E. Eckert and K. Gebhardt also spoke at a workshop for Nevada BLM resources personnel.

K. Gebhardt gave seven other presentations at agency workshops and twice served as an instructor at BLM training courses. He is coauthor of two BLM technical notes, Watershed Monitoring and Determining Hydraulic Properties of Soils.

K. Gebhardt also gave a presentation, "Erosion, productivity and rangeland watershed planning," at a Watershed Management Symposium of the American Soc. of Civil Engineers and completed draft versions of two video tapes on the ERHYM model.

William Platts gave 14 presentations based in part on his fisheries studies in the Great Basin at a variety of agency and professional meetings and workshops.

CHAPTER 1

CLIMATOLOGIC STUDIES

Karl Gebhardt and Carolyn Bohn

1985 Objectives

Complete inter-station correlation using all precipitation data.

1985 Accomplishments

Completed statistical analysis of all Saval Precipitation stations.

Prepared climatologic study proposal and received approval to begin project. Proposal involves cooperative work with the Nevada Watershed Study, Reynolds Creek Technology Transfer Project, and several Idaho, Montana, and Wyoming District Offices.

Operated and maintained 11 climate data stations.

Participated as a sampling location for the National Atmospheric Deposition Program which deals with the occurrence and effects of acid rain throughout the United States.

Precipitation Analysis

Precipitation data are now available for the Saval Project in a hardcopy format totaling 47 pages, an example of the document is shown in Table 1.1. This format includes all stations (see Figure 1.1) and all years through 1985.

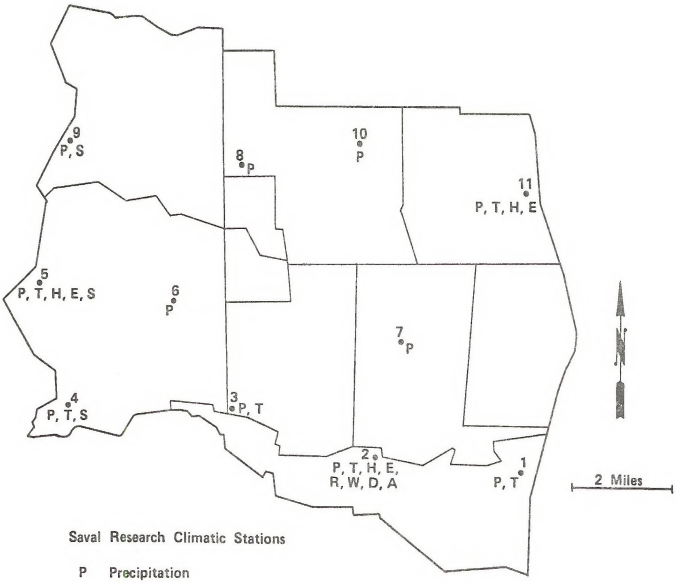
All precipitation data from 1980 through 1985 were analyzed using a multi-parameter linear regression program. Each year was analyzed independently of each other. Stations having R values greater than 0.75 were noted. Correlations between stations having R values greater than 0.75 for each and all years were included in an analysis using a combined data set. Results of the analysis showed very good correlation between sites 2 and 7, 3 and 7, 3 and 8, 3 and 10, 7 and 10, 7 and 11, and 10 and 11. R-squared values and regression coefficients are given in Table 1.2.

Figures 1.2 to 1.7 are plots of the daily precipitation of each of the stations from Table 1 with the exception of Stations 3 and 8. Datapoints less than 0.05 inches were not plotted because then each plot would contain over 300 datapoints within a small area. These analyses will be used to determine which station will be removed from operation. Sites 7, 8, and 10 appear to be the top candidate sites for discontinuation.

Figures 1.8 and 1.9 show the annual distribution of precipitation for 1984 and 1985 at the lower site number 2 and the higher elevation site number 5. Generally, the precipitation in the winter months is more evenly distributed than it is in the summer. Therefore, correlations between stations would be higher in the winter months.

TABLE I.I
PRECIPITATION DATA, INCHES FOR 1980, BY JULIAN DAY
SAVAL RANCH CLIMATE PROGRAM
STATIONS 1 THROUGH 11

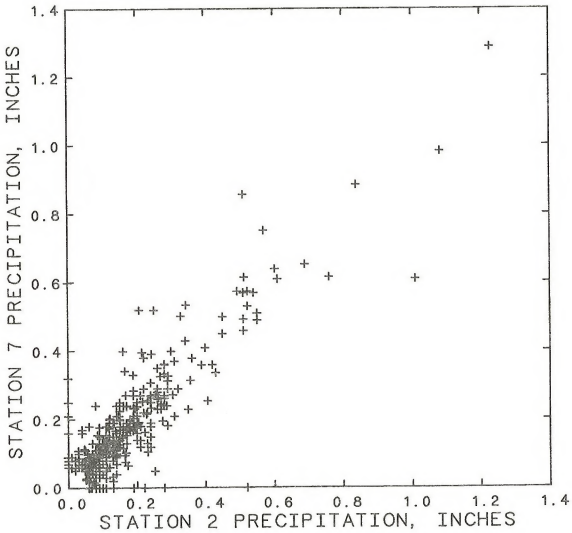
	STATION NUMBERS										
	1	2	3	4	5	6	7	8	9	10	11
1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000	0.000	0.000	0.030	0.000	0.000	0.000	0.000
6	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7	0.030	0.048	0.040	0.078	0.076	0.064	0.050	0.060	0.228	0.063	0.023
8	0.010	0.002	0.030	0.062	0.064	0.086	0.050	0.150	0.122	0.117	0.067
9	0.370	0.450	0.430	0.620	0.793	0.250	0.500	0.194	0.770	0.170	0.317
10	0.100	0.120	0.200	0.300	0.207	0.070	0.060	0.056	0.260	0.070	0.103
11	0.240	0.260	0.160	0.250	0.300	0.200	0.260	0.177	0.130	0.280	0.340
12	0.600	0.570	0.818	0.907	0.689	1.052	0.752	0.813	0.980	0.760	0.734
13	0.880	0.840	1.182	1.689	1.601	1.078	0.885	1.040	1.120	0.710	0.716
14	0.040	0.030	0.030	0.054	0.270	0.120	0.013	0.030	0.150	0.050	0.020
15	0.100	0.090	0.070	0.110	0.120	0.000	0.060	0.050	0.080	0.030	0.110
16	0.070	0.070	0.090	0.120	0.100	0.120	0.080	0.069	0.170	0.030	0.050
17	0.340	0.291	0.361	0.412	0.433	0.120	0.327	0.281	0.380	0.323	0.281
18	0.000	0.069	0.049	0.088	0.077	0.000	0.043	0.000	0.020	0.017	0.049
19	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
21	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.010	0.000	0.000
22	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
23	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
26	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
27	0.000	0.000	0.030	0.050	0.160	0.040	0.010	0.000	0.070	0.020	0.000
28	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
29	0.100	0.080	0.100	0.100	0.140	0.080	0.060	0.080	0.060	0.070	0.060
30	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
31	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
32	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
33	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
34	0.000	0.000	0.000	0.000	0.030	0.030	0.000	0.000	0.030	0.000	0.000
35	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
36	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
37	0.000	0.000	0.100	0.273	0.525	0.060	0.050	0.020	0.350	0.000	0.000
38	0.000	0.000	0.000	0.027	0.045	0.030	0.000	0.000	0.010	0.000	0.000
39	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
40	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
41	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
42	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
43	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.100	0.000	0.000	0.000
44	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
45	0.250	0.179	0.232	0.228	0.243	0.000	0.196	0.054	0.183	0.114	0.110
46	0.100	0.171	0.138	0.162	0.187	0.030	0.154	0.136	0.187	0.146	0.200
47	0.040	0.080	0.040	0.070	0.060	0.140	0.040	0.040	0.070	0.040	0.060



Saval Research Climatic Stations

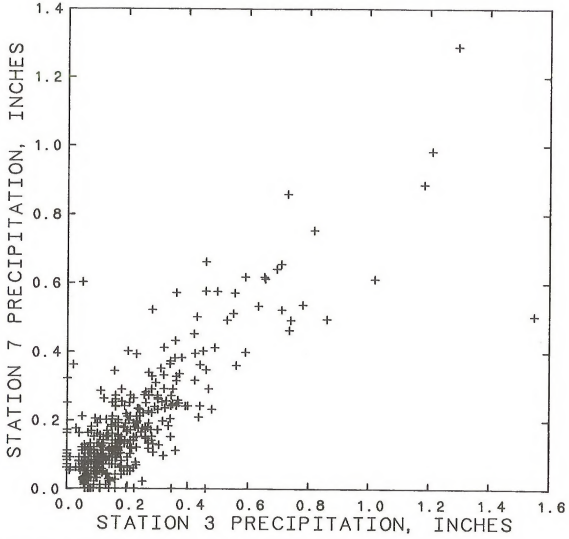
- P Precipitation
- T Temperature
- H Relative Humidity
- E Evaporation
- R Solar Radiation
- W Wind Speed and Direction
- D Dew Point Temperature
- S Snow Course
- A Atmospheric Deposition

Fig. 1.1



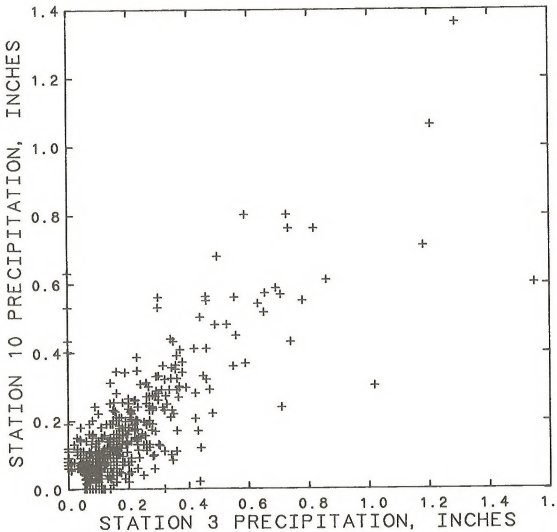
CORRELATION OF DAILY PRECIPITATION FOR STATION 2 AND STATION 7

Fig. 1.2



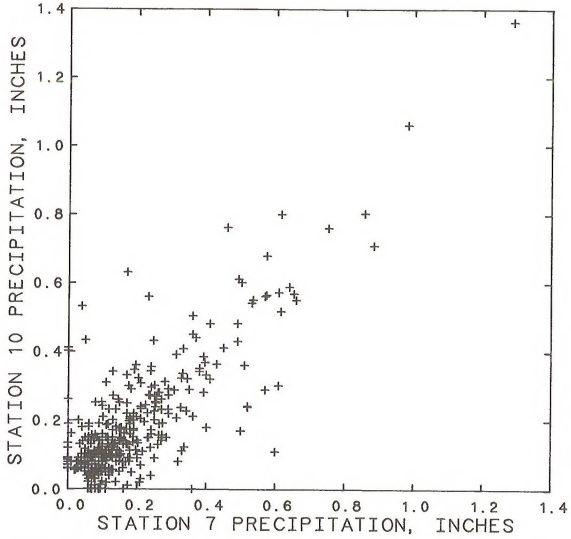
CORRELATION OF DAILY PRECIPITATION FOR STATION 3 AND STATION 7

Fig. 1.3



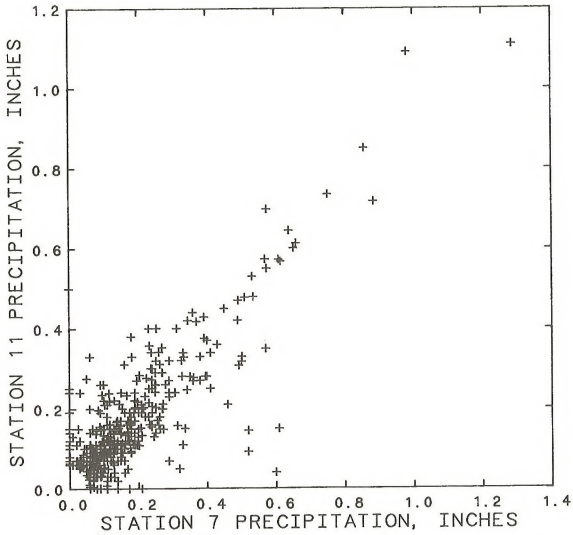
CORRELATION OF DAILY PRECIPITATION FOR STATION 3 AND STATION 10

Fig. 1.4



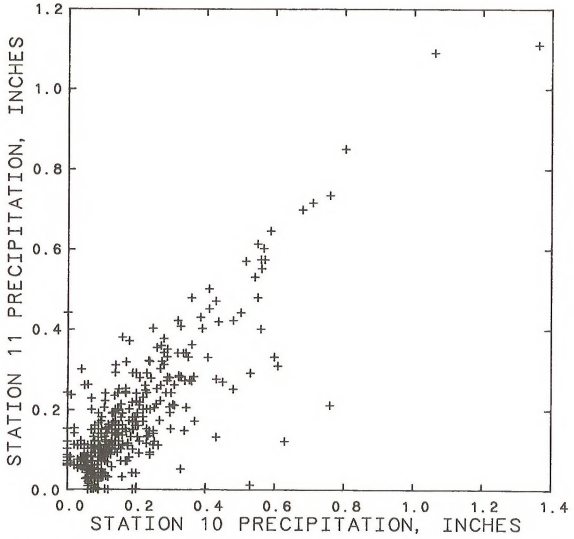
CORRELATION OF DAILY PRECIPITATION FOR STATION 7 AND STATION 10

Fig. 1.5



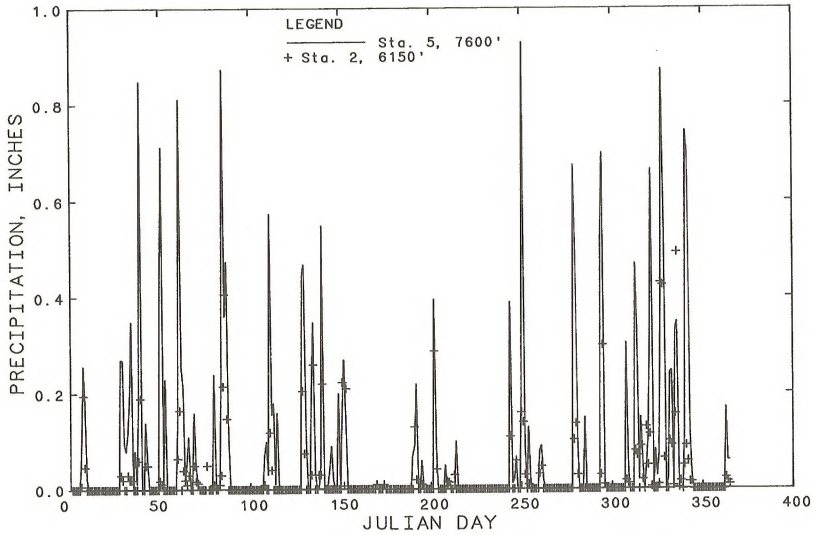
CORRELATION OF DAILY PRECIPITATION FOR STATION 7 AND STATION 11

Fig. 1.6



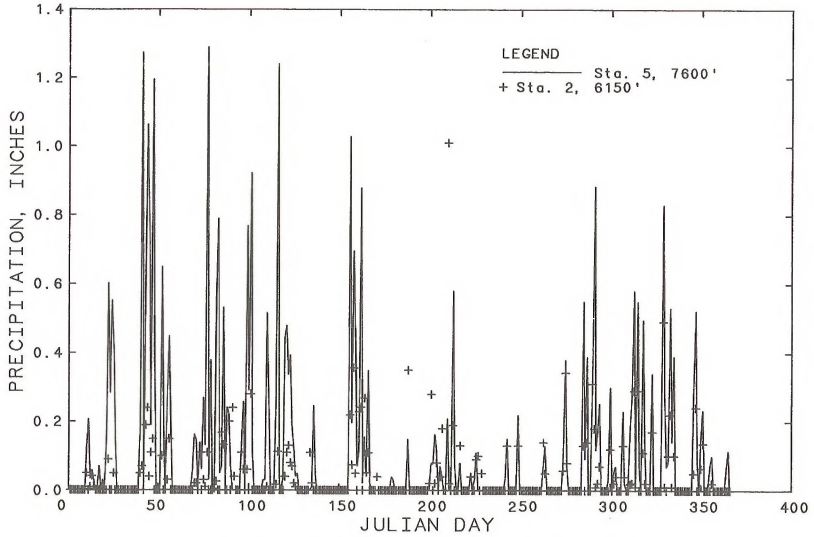
CORRELATION OF DAILY PRECIPITATION FOR STATION 10 AND STATION 11

Fig. 1.7



ANNUAL PRECIPITATION DISTRIBUTION, 1985, STATIONS 2 AND 5

Fig. 1.8



ANNUAL PRECIPITATION DISTRIBUTION, 1984, STATIONS 2 AND 5

Fig. 1.9

It can be concluded, particularly in the lower elevation of the Saval Project boundary, that precipitation can be predicted to a fairly high degree with a few well-placed stations. Further cooperative work with the Idaho State Office's CLIMDAT (climate data) project and the Nevada watershed studies should produce useful field direction on the location and interpretation of weather data. The CLIMDAT project is a cooperative effort between several Districts in Wyoming, Idaho, Montana, through the Reynold's Creek Technology Transfer Project.

Table 1.2. Precipitation Regression Analysis*

Station Variables		Regression coefficients			
Independent	Dependent	A	B	R^2	n
2	7	0.01	0.9675	0.86	474
3	7	0.0171	0.7383	0.76	520
3	8	0.0309	0.8571	0.73	535
3	10	0.0173	0.7187	0.74	527
7	10	0.0171	0.8626	0.75	491
7	11	0.0142	0.819	0.78	498
10	11	0.0173	0.8193	0.77	511

*Analysis done on days where both stations had values greater than 0.0. All estimated data were removed from data sets before analysis.

CHAPTER 2

HYDROLOGIC RESEARCH

Karl Gebhardt and Carolyn Bohn

1985 Objectives

Reduce the staff-gage data to discharge records for the lower Gance Creek and Mahala Creek Stations.

Begin geomorphology studies of the Gance Creek Stream channel within the study exclosure.

1985 Accomplishments

Completed reduction of lower Gance and Mahala Creek stage data.

Prepared riparian study proposal and received approval to begin project within the Gance Creek study exclosure.

Completed longitudinal survey of 182 transects within the Gance Creek study exclosure.

Completed the sampling of soil horizons on both banks on each transect within the Gance Creek Study exclosure.

Discontinued the upper and lower stream gaging stations on Gance Creek and Mahala Creek. Remaining stations were serviced.

Gaging Stations

A complete provisional record of the discharge data for the lower Gance Creek and Lower Mahala Creek stations are now available through the Agricultural Research Service Office in Boise, Idaho. Figures 2.1 to 2.3 and Figures 2.4 to 2.6 are the annual hydrographs (1983-1985) for the lower Mahala and Gance Creeks respectively. Daily data for the period of record for Lower Gance Creek are shown in Table 2.6. The gaging stations are now discontinued as of September 1, 1985.

The small watersheds, Mahala H, Gravel Pit, and U.S.F.S. #1 are being continued.

Data Availability

Data can be obtained in hardcopy format or magnetic format for mainframe or IBM compatible personal computers by contacting:

Karl Gebhardt
Agricultural Research Service
270 S. Orchard
Boise, Idaho 83705

(208) 334-1892 or (208) 334-1363

Table 2.1. STATION 09121010 LOWER GANCE CREEK - SAVAL RANCH (12307 ACRES) OPEN CHANNEL-RATED
DAILY SUMMARY OF RUNOFF FOR YEAR 1982
RUNOFF IN CFS (AVERAGE FOR PERIOD)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
1	0.000	0.000	0.000	15.549	46.737	13.140	1.761	0.230	0.000	0.324	0.693	0.000	1
2	0.000	0.000	0.000	13.992	54.587	13.607	1.350	0.190	0.000	0.262	0.609	0.000	2
3	0.000	0.000	0.000	11.840	61.884	12.116	2.034	0.176	0.000	0.237	0.558	0.000	3
4	0.000	0.000	0.000	13.192	61.935	10.043	4.226	0.168	0.000	0.225	0.559	0.000	4
5	0.000	0.000	5.720	11.077	52.381	9.768	5.015	0.067	0.000	0.236	0.568	0.000	5
6	0.000	0.000	0.000	9.460	42.829	12.871	4.427	0.000	0.000	0.233	0.561	0.000	6
7	0.000	0.000	10.072	7.800	37.710	9.901	3.824	0.000	0.000	0.227	0.554	0.000	7
8	0.000	0.000	8.514	9.679	36.601	6.922	4.131	0.000	0.000	0.237	0.561	0.000	8
9	0.000	0.000	10.383	7.309	36.822	5.429	3.914	0.000	0.000	0.242	0.568	0.000	9
10	0.000	0.000	11.886	8.364	32.842	4.479	3.335	0.000	0.000	0.247	0.621	0.000	10
11	0.000	0.000	13.358	17.803	30.600	4.096	2.741	0.000	0.000	0.257	0.603	0.000	11
12	0.000	0.000	14.409	31.516	25.611	4.562	2.527	0.000	0.000	0.263	0.496	0.000	12
13	0.000	0.000	12.440	32.334	21.406	6.495	2.285	0.000	0.000	0.306	0.000	0.000	13
14	0.000	0.000	15.200	35.131	20.471	6.954	1.931	0.000	0.000	0.325	0.000	0.000	14
15	0.000	0.000	14.796	36.182	20.847	6.161	1.755	0.000	0.000	0.343	0.000	0.000	15
16	0.000	0.000	13.185	32.781	21.481	3.836	1.642	0.000	0.000	0.340	0.000	0.000	16
17	0.000	0.000	10.969	30.263	23.530	2.860	1.490	0.000	0.000	0.337	0.000	0.000	17
18	0.000	0.000	10.779	28.218	46.047	2.673	1.454	0.000	0.000	0.330	0.000	0.000	18
19	0.000	0.000	9.734	25.543	34.028	2.367	1.402	0.000	0.000	0.325	0.000	0.000	19
20	0.000	0.000	9.272	23.931	25.150	2.266	1.255	0.000	0.000	0.352	0.000	0.000	20
21	0.000	0.000	7.551	22.336	19.623	2.330	1.071	0.000	0.000	0.358	0.000	0.000	21
22	0.000	0.000	7.302	22.204	18.487	10.596	0.739	0.000	0.000	0.352	0.000	0.000	22
23	0.000	0.000	7.607	24.618	18.604	8.646	0.465	0.000	0.000	0.353	0.000	0.000	23
24	0.000	0.000	8.076	25.635	17.720	6.182	0.424	0.000	0.153	0.394	0.000	0.000	24
25	0.000	0.000	10.555	30.871	17.446	6.065	0.620	0.000	1.756	0.490	0.000	0.000	25
26	0.000	0.000	13.341	36.965	18.488	4.149	0.393	0.000	1.026	0.746	0.000	0.000	26
27	0.000	0.000	14.737	39.954	19.180	2.519	0.655	0.000	0.354	0.660	0.000	0.000	27
28	0.000	0.000	17.908	46.332	20.071	0.000	0.777	0.000	0.272	0.565	0.000	0.000	28
29	0.000	0.000	15.426	49.916	18.036	0.000	0.528	0.000	0.281	0.974	0.000	0.000	29
30	0.000	0.000	13.498	47.299	16.027	2.159	0.398	0.000	0.311	1.110	0.000	0.000	30
31	0.000	0.000	13.633	0.000	14.105	0.000	0.312	0.000	0.000	0.813	0.000	0.000	31
AVE	0.000	0.000	9.689	24.937	30.042	6.106	1.899	0.027	0.138	0.402	0.232	0.000	

FLOWS IN WINTER SHOWING 0.000 ARE NOT NECESARILY O FLOW. INSTRUMENTATION (STILLING WELL) FROZEN.

Table 2.1 cont. STATION 09121010 LOWER GANCE CREEK - SAVAL RANCH (12307 ACRES) OPEN CHANNEL-RATED
DAILY SUMMARY OF RUNOFF FOR YEAR 1982
RUNOFF IN CFS (AVERAGE FOR PERIOD)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
1	0.000	0.000	5.759	18.741	40.655	102.245	3.797	0.086	0.000	0.566	0.792	1.661	1
2	0.000	0.000	17.050	25.767	38.653	80.883	3.706	0.064	0.000	0.516	0.762	1.696	2
3	0.000	0.000	16.708	17.636	40.933	73.223	2.679	0.074	0.000	0.507	0.720	1.887	3
4	0.000	0.000	17.344	17.143	45.834	101.431	1.751	0.009	0.000	0.476	0.706	1.272	4
5	0.000	0.000	17.287	17.843	58.859	78.978	1.312	0.000	0.000	0.458	0.706	2.753	5
6	0.000	0.000	15.390	16.269	55.950	63.155	0.983	0.000	0.000	0.439	0.706	2.489	6
7	0.000	0.000	13.788	14.828	47.202	55.391	1.376	0.000	0.000	0.443	0.748	2.687	7
8	0.000	0.000	16.325	15.015	45.062	50.651	1.776	0.000	0.000	0.491	0.748	3.854	8
9	0.000	0.000	16.611	17.761	46.335	39.502	1.661	0.000	0.000	0.691	0.720	2.608	9
10	0.000	0.000	17.834	19.209	44.568	36.156	2.332	0.112	0.000	0.770	0.810	2.831	10
11	0.000	0.000	23.672	18.223	40.467	36.257	2.329	0.692	0.000	0.596	1.084	2.550	11
12	0.000	0.000	22.309	16.653	36.348	34.169	1.995	0.242	0.000	0.527	1.045	1.493	12
13	0.000	0.000	41.976	15.552	31.735	29.924	1.514	0.156	0.000	0.560	1.160	1.914	13
14	0.000	0.000	33.430	14.817	29.236	24.448	1.261	0.131	0.000	0.581	0.965	3.200	14
15	0.000	0.000	23.229	14.847	29.652	21.753	1.423	0.164	0.000	0.559	0.886	10.646	15
16	0.000	0.000	19.916	15.834	33.014	20.614	1.516	0.261	0.000	0.559	0.903	11.253	16
17	0.000	0.000	18.175	17.217	31.480	17.059	1.236	0.244	0.000	0.559	1.196	5.343	17
18	0.000	0.000	16.479	19.865	32.597	14.957	1.029	0.197	0.000	0.559	1.108	6.515	18
19	0.000	0.000	14.886	23.167	35.656	15.396	0.899	0.224	0.000	0.559	0.896	3.621	19
20	0.000	0.000	14.318	28.357	40.847	15.390	0.799	0.463	0.000	0.559	1.038	5.492	20
21	0.000	0.000	13.925	32.052	52.395	15.943	0.645	0.574	0.000	0.559	1.450	10.665	21
22	0.000	0.000	13.173	36.921	72.958	14.671	0.566	0.582	0.000	0.559	2.609	11.560	22
23	0.000	0.000	11.324	45.438	83.796	12.606	0.578	0.451	2.651	0.559	1.067	17.214	23
24	0.000	0.000	12.333	80.337	90.070	11.005	0.460	0.321	0.337	0.638	1.415	16.062	24
25	0.000	1.169	11.359	76.777	96.534	10.255	0.312	0.232	0.129	0.750	1.602	1.865	25
26	0.000	2.356	8.995	61.835	108.311	9.736	0.293	0.177	0.167	0.653	1.737	4.012	26
27	0.000	2.471	9.804	47.829	112.535	8.993	0.275	0.137	0.220	0.617	3.215	5.432	27
28	0.000	2.469	8.068	42.033	106.119	6.639	0.255	0.130	0.354	0.604	1.332	26.530	28
29	0.000	0.000	8.237	52.221	111.790	4.829	0.184	0.108	0.510	0.593	1.377	17.770	29
30	0.000	0.000	15.120	48.312	115.543	4.117	0.059	0.069	0.691	0.587	1.472	3.682	30
31	0.000	0.000	21.422	0.000	118.437	0.000	0.062	0.002	0.000	0.740	0.000	4.561	31
AVE	0.000	0.302	16.653	29.617	60.438	33.679	1.260	0.190	0.169	0.575	1.166	6.294	

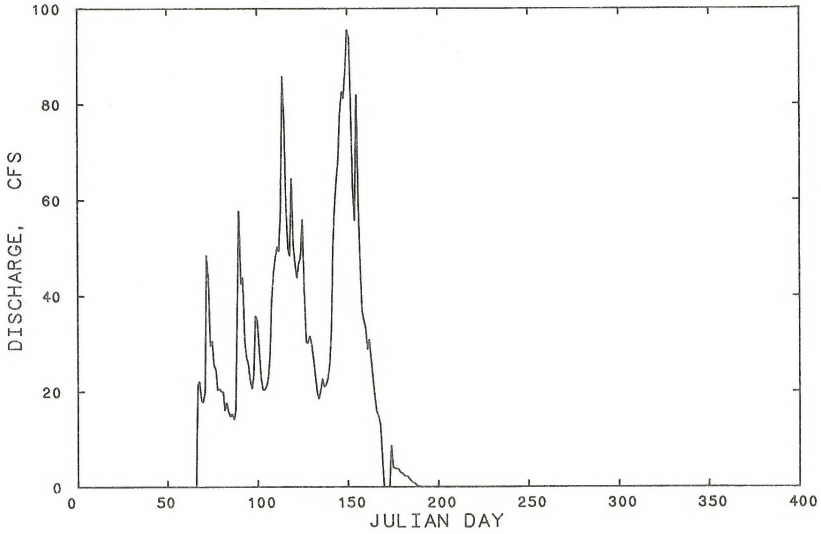
Table 2.1 cont. STATION 09121010 LOWER GANCE CREEK - SAVAL RANCH (12307 ACRES) OPEN CHANNEL-RATED
DAILY SUMMARY OF RUNOFF FOR YEAR 198#
RUNOFF IN CFS (AVERAGE FOR PERIOD)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
1	23.104	24.329	0.877	14.957	35.181	89.861	19.307	1.025	0.000	1.008	0.648	0.000	1
2	27.295	14.890	0.877	14.313	38.323	72.561	17.319	0.728	0.000	1.002	0.625	0.000	2
3	16.572	10.514	0.877	14.254	43.877	61.665	17.552	0.565	0.000	0.918	0.718	0.000	3
4	8.760	6.847	0.877	16.239	53.186	61.438	17.330	0.398	0.000	0.877	0.659	0.000	4
5	5.486	10.775	0.839	22.146	56.409	63.639	15.640	0.264	0.000	0.877	0.640	0.414	5
6	12.263	10.967	0.839	24.690	52.645	63.853	14.509	0.107	0.000	0.805	0.630	5.065	6
7	14.238	11.020	0.839	21.851	47.482	56.662	16.417	0.017	0.000	0.898	0.610	7.721	7
8	19.198	15.824	0.802	22.487	47.175	49.071	14.581	0.001	0.000	0.839	0.809	5.241	8
9	23.384	10.485	0.839	20.260	58.988	43.150	14.193	0.000	0.000	0.864	0.659	2.758	9
10	44.667	1.979	0.877	22.072	89.125	48.661	15.774	0.000	0.000	0.877	0.740	0.444	10
11	17.612	19.605	0.877	19.895	136.530	41.846	13.065	0.000	0.000	0.927	0.802	0.553	11
12	15.650	2.010	0.918	21.269	224.988	36.729	9.914	0.000	0.000	0.958	0.802	0.365	12
13	6.399	2.948	1.050	23.787	295.954	37.909	7.201	0.000	0.143	1.330	0.851	8.036	13
14	12.715	7.167	2.365	27.564	384.494	34.947	5.997	0.000	0.208	1.107	0.877	10.829	14
15	34.228	17.705	15.315	38.468	0.000	42.525	5.009	0.000	0.208	0.958	0.980	3.248	15
16	5.847	3.793	15.121	50.666	0.000	49.032	3.950	0.000	0.208	1.014	0.733	2.685	16
17	1.193	8.003	14.536	72.893	0.000	50.854	3.158	0.000	0.208	1.003	0.491	12.912	17
18	1.141	25.702	12.322	81.123	0.000	50.313	2.769	0.000	0.208	0.933	0.000	4.763	18
19	1.193	27.646	14.851	63.074	0.000	51.333	3.569	0.000	0.243	1.311	0.000	0.280	19
20	1.193	11.042	16.530	48.129	0.000	50.180	6.141	0.000	0.321	1.757	0.000	0.314	20
21	1.308	8.923	19.558	42.423	0.000	48.166	4.028	0.000	0.370	1.951	0.000	0.329	21
22	1.852	0.682	19.433	42.375	0.000	42.431	3.929	0.000	0.415	1.685	0.000	0.363	22
23	3.125	0.767	18.937	48.035	184.578	38.455	3.769	0.000	0.572	1.302	0.000	0.692	23
24	3.430	0.767	18.810	54.833	139.704	35.607	2.211	0.000	0.483	1.121	0.000	0.511	24
25	5.185	0.733	18.018	51.948	124.147	34.209	1.552	0.000	0.483	0.784	0.000	7.939	25
26	5.795	0.733	17.532	54.389	111.982	33.312	1.409	0.000	0.506	0.731	0.000	5.861	26
27	10.426	0.733	16.568	49.129	110.216	31.702	0.877	0.000	0.506	0.895	0.000	0.529	27
28	19.360	0.767	15.583	37.691	99.155	29.046	0.786	0.000	0.483	0.790	0.000	0.539	28
29	13.512	0.839	14.583	34.571	91.386	26.829	2.326	0.000	0.562	0.826	0.000	0.695	29
30	12.151	0.000	14.000	34.271	94.242	21.555	0.985	0.000	0.698	0.669	0.000	0.556	30
31	21.054	0.000	14.044	0.000	98.423	0.000	0.556	0.000	0.000	0.640	0.000	0.000	31
AVE	12.559	8.903	9.339	36.327	84.458	46.585	7.930	0.100	0.228	1.021	0.409	2.698	

Table 2.1 cont. STATION 09121010 LOWER GANCE CREEK - SAVAL RANCH (12307 ACRES) OPEN CHANNEL-RATED
DAILY, MONTHLY, AND YEARLY SUMMARY OF RUNOFF FOR YEAR 1985

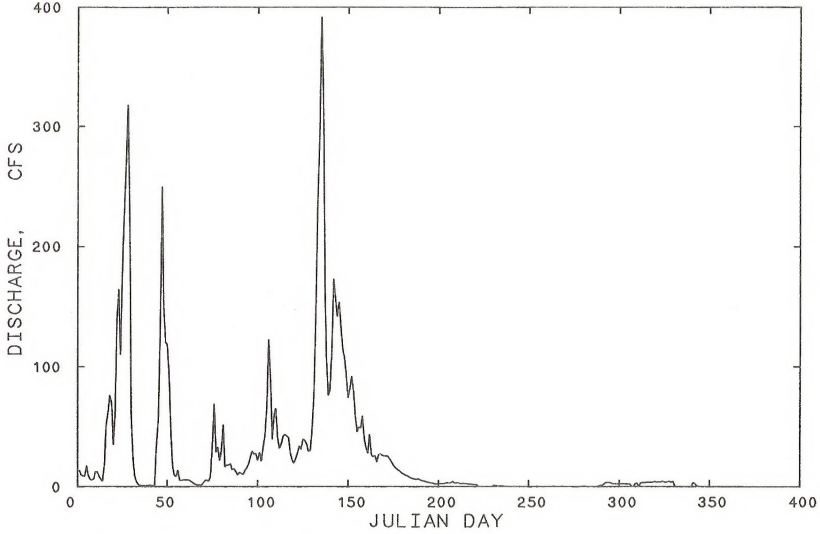
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
1	0.671	0.445	0.367	17.415	4.561	1.219	0.000	0.000	0.000	0.000	0.000	0.000	1
2	0.698	0.715	0.182	17.887	7.558	0.930	0.000	0.000	0.000	0.000	0.000	0.000	2
3	0.662	0.780	0.000	20.521	16.488	1.099	0.000	0.000	0.000	0.000	0.000	0.000	3
4	0.829	0.615	0.006	21.087	14.243	0.864	0.000	0.000	0.000	0.000	0.000	0.000	4
5	0.666	0.700	0.634	20.873	14.234	0.772	0.000	0.000	0.000	0.000	0.000	0.000	5
6	0.489	0.605	1.005	22.194	13.745	0.699	0.000	0.000	0.000	0.000	0.000	0.000	6
7	0.594	0.582	1.437	23.376	15.637	0.185	0.000	0.000	0.000	0.000	0.000	0.000	7
8	0.567	0.045	2.963	25.801	15.899	0.001	0.000	0.000	0.000	0.000	0.000	0.000	8
9	0.506	0.000	3.165	26.370	13.962	0.000	0.000	0.000	0.000	0.000	0.000	0.000	9
10	0.506	0.000	1.077	26.900	16.692	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10
11	0.506	0.000	1.125	27.068	14.838	0.000	0.000	0.000	0.000	0.000	0.000	0.000	11
12	0.671	0.000	1.164	27.066	13.564	0.000	0.000	0.000	0.000	0.000	0.000	0.000	12
13	2.147	0.000	1.256	26.725	12.271	0.000	0.000	0.000	0.000	0.000	0.000	0.000	13
14	0.938	0.000	1.889	26.889	9.161	0.000	0.000	0.000	0.000	0.000	0.000	0.000	14
15	0.467	0.000	3.739	27.871	7.940	0.000	0.000	0.000	0.000	0.000	0.000	0.000	15
16	0.468	0.000	5.025	28.029	12.329	0.000	0.000	0.000	0.000	0.000	0.000	0.000	16
17	0.529	0.000	8.465	26.723	6.037	0.000	0.000	0.000	0.000	0.000	0.000	0.000	17
18	0.616	0.000	13.672	26.551	5.145	0.000	0.000	0.000	0.000	0.000	0.000	0.000	18
19	0.701	0.000	17.937	25.804	5.355	0.000	0.000	0.000	0.000	0.000	0.000	0.000	19
20	0.698	0.000	17.095	22.578	7.773	0.000	0.000	0.000	0.000	0.000	0.000	0.000	20
21	0.677	0.225	17.646	21.005	12.960	0.000	0.000	0.000	0.000	0.000	0.000	0.000	21
22	0.580	0.576	12.564	19.788	10.252	0.000	0.000	0.000	0.000	0.000	0.000	0.000	22
23	1.309	0.544	13.298	15.774	6.558	0.000	0.000	0.000	0.000	0.000	0.000	0.000	23
24	0.552	0.531	14.746	7.228	3.336	0.000	0.000	0.000	0.000	0.000	0.000	0.000	24
25	4.345	0.531	13.902	5.818	3.343	0.000	0.000	0.000	0.000	0.000	0.000	0.000	25
26	0.582	0.119	8.529	3.993	3.462	0.000	0.000	0.000	0.000	0.000	0.000	0.000	26
27	0.646	0.049	3.194	3.459	2.741	0.000	0.000	0.000	0.000	0.000	0.000	0.000	27
28	0.707	0.047	5.858	2.827	1.728	0.000	0.000	0.000	0.000	0.000	0.000	0.000	28
29	0.749	0.000	11.110	2.656	1.226	0.000	0.000	0.000	0.000	0.000	0.000	0.000	29
30	0.701	0.000	9.331	3.011	1.105	0.000	0.000	0.000	0.000	0.000	0.000	0.000	30
31	1.101	0.000	9.226	0.000	0.961	0.000	0.000	0.000	0.000	0.000	0.000	0.000	31
AVE	0.835	0.254	6.503	19.110	8.874	0.192	0.000	0.000	0.000	0.000	0.000	0.000	

GAGE DISCONTINUED OCTOBER 1, 1985



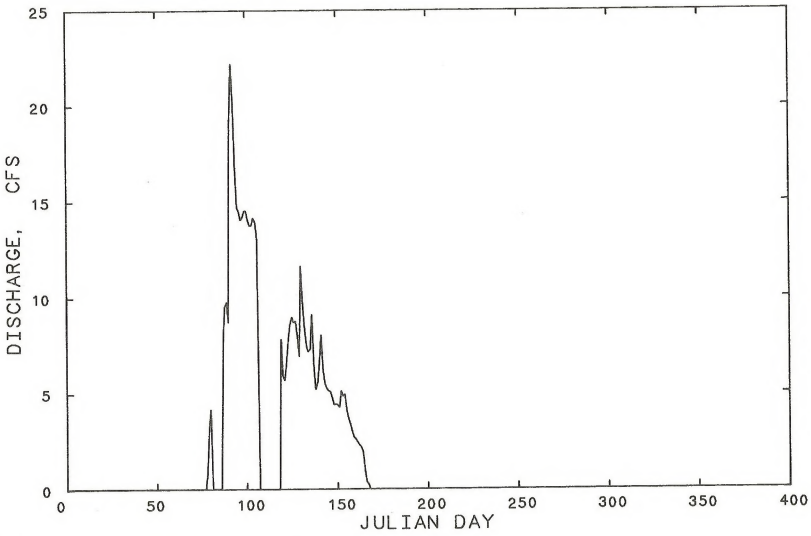
LOWER MAHALA ANNUAL HYDROGRAPH 1983

Fig. 2.1



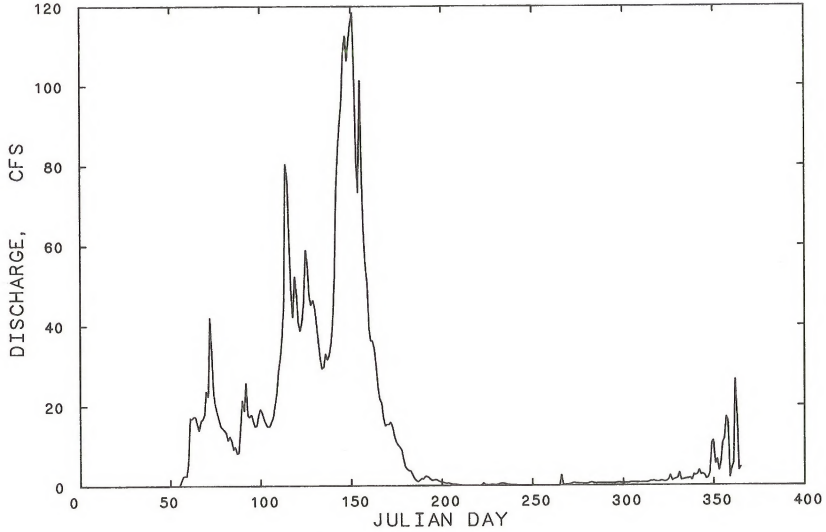
LOWER MAHALA ANNUAL HYDROGRAPH 1984

Fig. 2.2



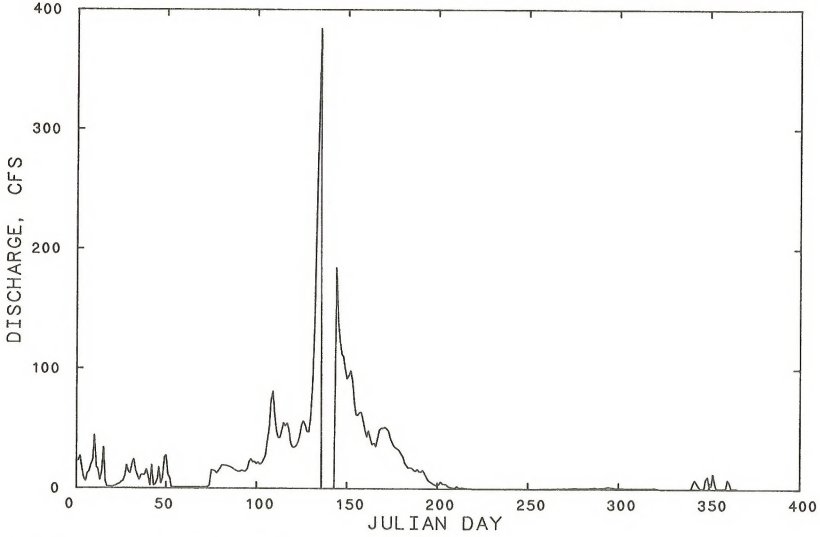
LOWER MAHALA ANNUAL HYDROGRAPH 1985

Fig. 2.3



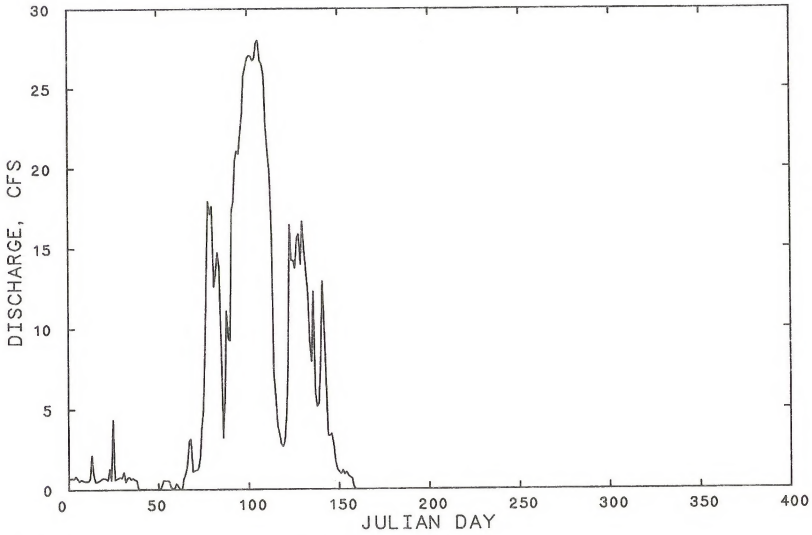
LOWER GANCE ANNUAL HYDROGRAPH 1983

Fig. 2.4



LOWER GANCE ANNUAL HYDROGRAPH 1984

Fig. 2.5



LOWER GANCE ANNUAL HYDROGRAPH 1985

Fig. 2.6

Service and Maintenance

All gaging stations and climate stations were serviced. The ARS from Boise, Idaho provides servicing for clocks, cleaning of precipitation gages, reduction of charts, maintenance of critical fluids, and computer assistance. Dr. Keith Cooley, acting location leader for the ARS in Boise, and his staff provided valuable assistance in this phase of the program.

Riparian Research

The riparian research project was initiated in the summer of 1985. Further description of the Riparian Study proposal can be found in the Saval Project Research Proposals. Soil samples were taken from both streambanks on 180 transects within the existing exclosure. The samples are being analyzed in Boise, Idaho for soil texture to determine stability properties for use in describing bank failure mechanisms. A paper on streambank failure mechanisms is planned for presentation at the Range Society symposium in February of 1987.

A survey was completed during the summer of 1985 to determine the differences in elevation of each transect within the exclosure. The survey has been reduced and entered into a computer. These measurements will be used with the previous cross-section measurements taken in 1980 - 1985 as input to a streamflow model to estimate the stage and velocity of flow at each of the transects in Gance Creek. These datas will be used to recreate flow histories on Gance Creek that may led to a bank failure prediction technique. Also, the data will be used in related bank erosion studies dealing with vegetation.

During November of 1985 the Bureau of Land Management established an Riparian Management Taskforce consisting of specialists from several State and direct Offices. Karl Gebhardt of the Saval Project was named chairman of the Riparian Classification workgroup within the Riparian Taskforce. Saval has been targeted as a test area for the Bureau's classification procedure. In addition, Sherman Swanson, of UNR and also with the Saval Project, has been working on a similar riparian classification project for Nevada. Dr. Swanson will be using the Saval Area to test the Nevada Classification procedures. Both classification projects are being coordinated together. The tests, during the summer of 1986, should be very helpful in developing a common classification procedure for riparian zones.

Acknowledgments

Thanks to our spring volunteer, David Zuber, for his help in operating and maintaining the climate stations. Special thanks to Steve Biatowas, our summer and fall volunteer, who spent many hours collecting the streambank soil samples on Gance Creek. We appreciate the help of April Wilson for her work on data reduction. Thanks to Sue Jackson, of the ARS, for help in computerization of the Saval's data base.

CHAPTER 3

VEGETATION RESEARCH

D. Waive Stager and Richard E. Eckert, Jr.

PART A: VEGETATION MONITORING SUMMARY

1979 Through 1985 Objectives:

1. Establish, and periodically read, permanently marked transects to determine change in species frequency and ground cover characteristics on various upland and riparian range sites.

2. Sample for change in density and cover of tree and shrub species on the permanently marked transects established in Objective 1 on upland range sites.

1979 Through 1985 Accomplishments:

Methods. Permanently marked plots for vegetation monitoring were located on a range site basis. On each upland range site, a 100 ft. base line was permanently marked (angle iron stakes at the 0 and 100 ft. ends). Ten randomly selected lines perpendicular to the base line were also permanently located for sampling frequency of all species, ground cover, and for canopy cover and density of shrubs and trees. Frequency of occurrence in 1979 through 1983 was determined with the single-size quadrat method with 20 quadrats per transect for a total of 200 quadrats per site sampled. Quadrats were located contiguously along each transect line. Quadrat size depended on vegetation density. The 20 x 20 in. quadrat usually gave frequencies of between 30 and 70% for common species on the upland range sites. The 10 x 10 in. quadrat was generally used on the Wet Meadow Range Site. However, it was necessary to use smaller quadrats for the most common species. On the Wet Meadow Range Site, the length and number of transects and the number of quadrats per transect depended on the size of the site sampled. Transects varied from three to five in number, from 30 to 100 ft. in length, and with from 10 to 20 quadrats per transect.

In 1984, the nested-plot method of frequency sampling (Winward and Martinez 1983) was used. The nested-plot approach allowed the evaluation of data for each species from more than one quadrat size since frequency values are computer-generated for different quadrat sizes. This is valuable if a large change in species frequency occurs over time and data must be interpreted from a quadrat size different from that used in other years. Each quadrat consisted of a "nest" of three quadrat sizes. On upland sites these sizes were 5 x 5 in., 10 x 10 in., and 20 x 20 in. Quadrat sizes used on meadow sites were 2.5 x 2.5 in., 5 x 5 in., and 10 x 10 in.

Living and non-living ground cover was estimated from three points on each frequency quadrat.

Canopy cover of trees and shrubs on upland sites was estimated by the line intercept method (Canfield, 1941) along the 10 transects used for sampling frequency and ground cover. Transects were 50 ft. long.

Tree and shrub density was determined by species and age class (i.e., seedling, young, mature, decadent, and dead) from 10 belt transects, 3.3 ft. wide and 50 ft. long. The belts were located on the right hand side of each frequency and ground cover transect.

The Soil Conservation Service (SCS) visited most of the nonmeadow monitoring plots and verified their range site designations. SCS also provided a visual estimate of range condition for each plot area.

Results. From 1979 through 1985, 173 vegetation monitoring plots were established, permanently marked, and sampled on the Saval Allotment. Of these, 92 plots have been resampled at least once. Table 3.1 lists all these plots, the range site sampled, the pasture location, and the years when frequency of occurrence and ground cover data were collected. Table 3.2 lists the same information for tree and shrub canopy cover and density samples.

Thirty-three monitoring plots were established in the Lower Sheep Creek (LSC), East Darling (EDS), West Darling (WDS), and Darling Control (DC) Pastures. Two of these were abandoned when the LSC Pasture was plowed and seeded in 1981. Three of the remaining 31 plots are on riparian areas (Wet Meadow 10-16" and Loamy Bottom 8-14" Range Sites) and six are on undisturbed native vegetation (Loamy 8-10" and Claypan 10-12" Range Sites) within the boundaries of these seeded pastures. The rest of the plots (22) are on seeded areas within the four pastures. These plots were established to monitor vegetation changes on both seeded and undisturbed plant communities under a 3-pasture deferred-rotation grazing system (LSC, EDS, and WDS) and under a season-long system (DC).

Fifty-nine monitoring plots were established in Upper Sheep Creek (USC), Upper Mahala Creek (UMC), Middle Mahala Creek (MMC), Lower Mahala Creek (LMC) and Mahala Control (MC) Pastures. These are BLM pastures with native vegetation. Of the 59 plots, 16 are on riparian sites while the others are on upland sites. These plots were established to monitor vegetation changes under a 3-pasture rest-rotation grazing system on the USC, UMC, and MMC Pastures and a season-long system on the MC Pasture. No grazing system was designated for the LMC Pasture.

Grazing on the North and South National Forest (NNF and SNF) Pastures is under a 2-pasture deferred rotation system. Eighty-one plots were established to monitor the vegetation response to this system. Of these, 39 plots are on riparian sites (Riparian Aspen, Wet Meadow and Dry Meadow Range Sites) and 42 are on a variety of upland sites.

All monitoring data collected from these 173 plots between 1979 and 1985 have been entered and stored on BLM's DP5-8 Honeywell computer system in Denver.

Stored data consist of four types: 1. Frequency of occurrence for all species, 2. Ground Cover attributes, 3. Canopy Cover of tree and shrub species, and 4. Density of tree and shrub species.

All data files are formatted for use with the ASPN data management program. There is a separate ASPN data base for each type of monitoring data. These data bases are located in the NS076 removable pack. ASPN data bases are: FREQUENC (Frequency), GRCOVER (Ground Cover), TSCOVER (Canopy Cover), and TSDENSIT (Density).

Individual data sets are stored by pasture in subcatalogs by data type. For example, frequency data for monitoring plot #81-01 is stored in the MMC (Middle Mahala Creek Pasture) data file under the subcatalog FREQ on removable pack NS076 under user number A212. Subcatalogs for the other types of data are GRCOV (Ground Cover), TSCOV (Canopy Cover), and TSDENS (Density).

Data for individual plots are stored by pasture as follows:

Data Files*	Pasture
NSF and TSNF	South National Forest
SNF and TNNF	North National Forest
USC and TUSC	Upper Sheep Creek
UMC and TUMC	Upper Mahala Creek
MMC and TMMC	Middle Mahala Creek
LMC	Lower Mahala Creek
MC and TMC	Mahala Control
LSC and TLSC	Lower Sheep Creek
EDS	East Darling Seeding
WDS and TWDS	West Darling Seeding
DC	Darling Control

Three 'hard copy' sets of data have been produced. One copy is stored in Elko, one with ARS in Reno, and one with the BLM project coordinator in Reno.

Data from these permanently marked plots are considered to be 'repeated measures' of a population. Statistical analyses of the data must therefore be done using analysis of variance routines for this sampling design.

*Data files beginning with a 'T' contain Wet Meadow Range Site data.

Table 3.1. List of Saval Allotment vegetation monitoring plots, the range sites sampled, the pasture location, and the years frequency of occurrence and ground cover data were collected.

1. BLM seeded pastures

Plot number	Range site name	Pasture*	Year of first sample	Year of second sample	Year of third sample
79-02	Claypan 10-12"	LSC	1979	abandoned	--
79-11	Loamy Bottom 8-14"	LSC	1979	1984	--
79-15	Loamy 8-10"	LSC	1979	abandoned	--
79-17	Seeding	WDS	1979	1982	1985
79-18	Seeding	WDS	1979	1982	1985
80-01	Seeding	EDS	1980	1982	1984
80-02	Seeding	WDS	1980	1985	--
80-03	Seeding	WDS	1980	1985	--
80-04	Seeding	WDS	1980	1985	--
80-05	Seeding	DC	1980	1985	--
80-06	Seeding	DC	1980	1985	--
80-07	Seeding	DC	1980	1985	--
80-08	Seeding	DC	1980	1985	--
80-09	Seeding	DC	1980	1985	--
80-10	Seeding	DC	1980	1985	--
82-14	Seeding	EDS	1982	1984	--
82-15	Seeding	EDS	1982	1984	--
82-16	Seeding	EDS	1982	1984	--
82-17	Seeding	EDS	1982	1984	--
83-01	Seeding	LSC	1983	1984	--
83-02	Seeding	LSC	1983	1984	--
83-03	Seeding	LSC	1983	1984	--
83-04	Seeding	LSC	1983	1984	--
83-05	Seeding	LSC	1983	1984	--
83-06	Seeding	LSC	1983	1984	--
84-01	Loamy 8-10"	EDS	1984	--	--
84-02	Claypan 10-12"	EDS	1984	--	--
84-04	Claypan 10-12"	LSC	1984	--	--
84-05	Loamy 8-10"	LSC	1984	--	--
85-01	Loamy 8-10"	WDS	1985	--	--
85-02	Claypan 10-12"	WDS	1985	--	--
T80-01	Wet Meadow 10-16"	LSC	1980	--	--
T81-01	Wet Meadow 10-16"	WDS	1981	1984	--

*Pasture Kay: LSC = Lower Sheep Creek
EDS = East Darling Seeding
WDS = West Darling Seeding
DC = Darling Seeding

Table 3.1 cont.

2. BLM Native Pastures

Plot number	Range site name	Pasture*	Year of first sample	Year of second sample	Year of third sample
79-01	Claypan 10-12"	UMC	1979	1982	1985
79-07	Loamy Bottom 8-14"	MMC	1979	washed out	washed out
79-08	Loamy Bottom 8-14"	USC	1979	--	--
79-16	Loamy 8-10"	LMC	1979	1982	1984
79-19	Loamy 10-12"	UMC	1979	1982	1985
80-15	Claypan 10-12"	USC	1980	--	--
80-16	Claypan 10-12"	USC	1980	--	--
80-17	Claypan 12-16"	USC	1980	--	--
80-18	Loamy 8-10"	USC	1980	--	--
80-19	Claypan 10-12"	USC	1980	--	--
80-20	Loamy 10-12"	USC	1980	--	--
80-21	L. Slope 10-16"	USC	1980	--	--
80-22	Claypan 10-12"	USC	1980	--	--
80-23	Loamy 10-12"	USC	1980	--	--
80-24	Loamy 10-12"	USC	1980	--	--
80-25	L. Slope 10-16"	USC	1980	--	--
80-26	Claypan 12-16"	USC	1980	--	--
80-27	L. Slope 10-16"	USC	1980	--	--
81-01	Claypan 10-12"	MMC	1981	1984	--
81-02	Loamy 10-12"	UMC	1981	1985	--
81-03	Loamy 10-12"	UMC	1981	1985	--
81-04	Claypan 10-12"	MMC	1981	1984	--
81-05	Loamy 8-10"	MMC	1981	1984	--
81-06	Loamy 10-12"	MMC	1981	1984	--
81-07	Claypan 10-12"	MMC	1981	1984	--
81-08	L. Slope 10-16"	UMC	1981	1985	--
81-09	L. Slope 10-16"	UMC	1981	1985	--
81-10	L. Slope 10-16"	UMC	1981	1985	--
82-01	Loamy 8-10"	LMC	1982	1984	--
82-02	Claypan 10-12"	MC	1982	1984	--
82-03	Loamy 10-12"	MC	1982	1984	--
82-04	Dry Meadow 10-16"	MC	1982	--	--
82-05	Loamy 8-10"	MC	1982	1984	--
82-06	Loamy 10-12"	MC	1982	1984	--
82-07	Claypan 10-12"	MC	1982	1984	--
82-08	Loamy 10-12"	MC	1982	1984	--
82-09	Claypan 10-12"	MC	1982	1984	--
82-10	Loamy 10-12"	UMC	1982	1985	--
82-11	Claypan 10-12"	UMC	1982	1985	--
82-12	Loamy 10-12"	UMC	1982	1985	--
82-13	Loamy 8-10"	UMC	1982	1985	--
82-18	Claypan 10-12"	UMC	1982	1985	--
82-19	Claypan 10-12"	LMC	1982	1984	--
83-07	Loamy 8-10"	USC	1983	--	--
83-08	Loamy 10-12"	MMC	1983	--	--
84-03	Claypan 12-16"	MC	1984	--	--
T79-05	Wet Meadow 10-16"	UMC	1979	1984	--

Table 3.1 cont.

T80-02	Wet Meadow 10-16"	USC	1980	--	--
T80-03	Wet Meadow 10-16"	USC	1980	--	--
T80-04	Wet Meadow 10-16"	USC	1980	--	--
T81-02	Wet Meadow 10-16"	UMC	1981	1984	--
T81-03	Wet Meadow 10-16"	MMC	1981	1984	--
T81-04	Wet Meadow 10-16"	MMC	1981	1984	--
T81-05	Wet Meadow 10-16"	MMC	1981	1984	--
T81-06	Wet Meadow 10-16"	MMC	1981	--	--
T83-01	Wet meadow 10-16"	MC	1983	--	--
T84-01	Wet Meadow 10-16"	UMC	1984	--	--
T84-06	Wet Meadow 10-16"	MMC	1984	--	--
T84-07	Wet Meadow 10-16"	Exclosure	1984	--	--

*Pasture Key: USC = Upper Sheep Creek
UMC = Upper Mahala Creek
MMC = Middle Mahala Creek
LMC = Lower Mahala Creek
MC = Mahala Control

3. National Forest native pastures:

Plot number	Range site name	Pasture*	Year of first sample	Year of second sample	Year of third sample
79-03	Mtn. Ridge 16+"	NNF	1979	1985	--
79-04	Claypan 12-16"	NNF	1979	1985	--
79-05	Mtn. Ridge 16+"	SNF	1979	1982	--
79-06	Mtn. Ridge 16+"	NNF	1979	1985	--
79-09	S. Slope 12-14"	SNF	1979	--	--
79-10	L. Slope 10-16"	NNF	1979	1985	--
79-13	L. Slope 10-16"	SNF	1979	1982	--
79-14	L. Slope 10-16"	NNF	1979	1985	--
79-20	Aspen Thicket 16+"	SNF	1979	--	--
79-21	Aspen Woodland	SNF	1979	1982	--
79-22	Riparian Aspen	SNF	1979	--	--
79-23	L. Slope 16+"	NNF	1979	1985	--
79-24	Steep N. Slope 16+"	SNF	1979	--	--
79-25	Steep N. Slope 16+"	NNF	1979	1985	--
79-26	Aspen Thicket	NNF	1979	--	--
79-27	Snow Pocket 16+"	SNF	1979	--	--
79-28	Steep N. Slope 16+"	NNF	1979	1985	--
80-28	Claypan 12-16"	NNF	1980	1985	--
80-29	Claypan 12-16"	NNF	1980	1985	--
80-30	S. Slope 14-18"	NNF	1980	1985	--
80-31	Mtn. Ridge 16+"	NNF	1980	1985	--
80-32	S. Slope 14-18"	NNF	1980	1985	--
80-33	Claypan 12-16"	NNF	1980	1985	--
80-34	S. Slope 12-14"	NNF	1980	1985	--
80-35	Riparian Aspen	NNF	1980	1985	--
80-36	S. Slope 14-18"	NNF	1980	1985	--
80-37	Aspen Woodland	NNF	1980	1985	--
80-38	L. Slope 16+"	NNF	1980	1985	--

Table 3.1 cont.

80-39	S. Slope 12-14"	NNF	1980	1985	--
81-11	Dry Meadow 10-16"	SNF	1981	--	--
81-12	Dry Meadow 10-16"	SNF	1981	--	--
81-13	Riparian Aspen	SNF	1981	--	--
81-14	Dry Meadow 10-16"	SNF	1981	--	--
81-15	Aspen Woodland	SNF	1981	--	--
81-16	S. Slope 14-18"	SNF	1981	--	--
81-17	S. Slope 14-18"	SNF	1981	--	--
81-18	Claypan 12-16"	SNF	1981	--	--
81-19	Aspen Woodland	SNF	1981	--	--
81-20	S. Slope 12-14"	SNF	1981	--	--
81-21	S. Slope 12-14"	SNF	1981	--	--
81-22	S. Slope 12-14"	SNF	1981	--	--
81-23	L. Slope 16+"	SNF	1981	--	--
81-24	Aspen Woodland	SNF	1981	--	--
81-25	Claypan 12-16"	SNF	1981	--	--
81-26	S. Slope 12-14"	SNF	1981	--	--
82-20	Dry Meadow 10-16"	NNF	1982	1985	--
82-21	L. Slope 10-16"	NNF	1982	1985	--
83-09	Riparian Aspen	NNF	1985	--	--
83-10	S. Slope 12-14"	NNF	1983	1985	--
83-11	L. Slope 16+"	NNF	1983	1985	--
T79-01	Wet Meadow 10-16"	SNF	1979	--	--
T79-02	Wet Meadow 10-16"	SNF	1979	1984	--
T79-03	Wet Meadow 10-16"	SNF	1979	1984	--
T79-04	Wet Meadow 10-16"	SNF	1979	--	--
T80-05	Wet Meadow 10-16"	NNF	1980	1983	--
T80-06	Wet Meadow 10-16"	NNF	1980	1983	--
T80-07	Wet Meadow 10-16"	NNF	1980	1983	--
T80-08	Wet Meadow 10-16"	NNF	1980	1983	--
T80-09	Wet Meadow 10-16"	NNF	1980	--	--
T80-10	Wet Meadow 10-16"	NNF	1980	--	--
T80-11	Wet Meadow 10-16"	NNF	1980	--	--
T80-12	Wet Meadow 10-16"	NNF	1980	--	--
T80-13	Wet Meadow 10-16"	NNF	1980	1983	--
T80-14	Wet Meadow 10-16"	NNF	1980	--	--
T80-15	Wet Meadow 10-16"	NNF	1980	--	--
T80-16	Wet Meadow 10-16"	NNF	1980	--	--
T81-07	Wet Meadow 10-16"	SNF	1981	--	--
T81-08	Wet Meadow 10-16"	SNF	1981	--	--
T81-09	Wet Meadow 10-16"	SNF	1981	--	--
T81-10	Wet Meadow 10-16"	SNF	1981	1984	--
T81-11	Wet Meadow 10-16"	SNF	1981	--	--
T82-01	Wet Meadow 10-16"	NNF	1982	--	--
T82-02	Wet Meadow 10-16"	NNF	1982	--	--
T82-03	Wet Meadow 10-16"	NNF	1982	--	--
T82-04	Wet Meadow 10-16"	NNF	1982	--	--
T82-05	Wet Meadow 10-16"	NNF	1982	--	--
T83-02	Wet Meadow 10-16"	NNF	1983	--	--
T84-02	Wet Meadow 10-16"	SNF	1984	--	--

Table 3.1 cont.

T84-03	Wet Meadow 10-16"	SNF	1984	--	--
T84-04	Wet Meadow 10-16"	SNF	1984	--	--
T84-05	Wet Meadow 10-16"	SNF	1984	--	--

Pasture Key: NNF = North National Forest
SNF = South National Forest

Table 3.2. List of Saval Allotment vegetation monitoring plots, the range sites sampled, the pasture location, and the years tree and shrub canopy cover and density data were collected. Trees and shrubs did not occur on the snow pocket, dry meadow, and wet meadow range sites.

1. BLM seeded pastures

Plot number	Range site	Pasture*	Year of first sample	Year of second sample	Year of third sample
79-02	Claypan 10-12"	LSC	abandoned	abandoned	---
79-11	Loamy Bottom 8-14"	LSC	1984	--	--
79-15	Loamy 8-10"	LSC	abandoned	abandoned	--
79-17	Seeding	WDS	1982	1985	--
79-18	Seeding	WDS	1981	1985	--
80-01	Seeding	EDS	1981	1984	--
80-02	Seeding	WDS	1981	1985	--
80-03	Seeding	WDS	1981	1985	--
80-04	Seeding	WDS	1981	1985	--
80-05	Seeding	DC	1981	1985	--
80-06	Seeding	DC	1981	1985	--
80-07	Seeding	DC	1981	1985	--
80-08	Seeding	DC	1981	1985	--
80-09	Seeding	DC	1981	1985	--
80-10	Seeding	DC	1981	1985	--
82-14	Seeding	EDS	1982	1984	--
82-15	Seeding	EDS	1982	1984	--
82-16	Seeding	EDS	1982	1984	--
82-17	Seeding	EDS	1982	1984	--
83-01	Seeding	LSC	1983	1984	--
83-02	Seeding	LSC	1983	1984	--
83-03	Seeding	LSC	1983	1984	--
83-04	Seeding	LSC	1983	1984	--
83-05	Seeding	LSC	1983	1984	--
83-06	Seeding	LSC	1983	1984	--
84-01	Loamy 8-10"	EDS	1984	--	--
84-02	Claypan 10-12"	EDS	1984	--	--
84-04	Claypan 10-12"	LSC	1984	--	--
84-05	Loamy 8-10"	LSC	1984	--	--
85-01	Loamy 8-10"	WDS	1985	--	--
85-02	Claypan 10-12"	WDS	1985	--	--

*Pasture Key: LSC = Lower Sheep Creek
EDS = East Darling Seeding
WDS = West Darling Seeding
DC = Darling Control

Table 3.2 cont.

2. BLM native pastures:

Plot number	Range site name	Pasture*	Year of first sample	Year of second sample	Year of third sample
79-01	Claypan 10-12"	UMC	1981	1985	--
79-07	Loamy Bottom 8-14"	MMC	1981	washed out	washed out
79-08	Loamy Bottom 8-14"	USC	1982	--	--
79-16	Loamy 8-10"	LMC	1981	1984	--
79-19	Loamy 10-12"	UMC	1981	1985	--
80-15	Claypan 10-12"	USC	1982	--	--
80-16	Claypan 10-12"	USC	1982	--	--
80-17	Claypan 12-16"	USC	1982	--	--
80-18	Loamy 8-10"	USC	1982	--	--
80-19	Claypan 10-12"	USC	1982	--	--
80-20	Loamy 10-12"	USC	1982	--	--
80-21	L. Slope 10-16"	USC	1982	--	--
80-22	Claypan 10-12"	USC	1982	--	--
80-23	Loamy 10-12"	USC	1982	--	--
80-24	Loamy 10-12"	USC	1982	--	--
80-25	L.Slope 10-16"	USC	1982	--	--
80-26	Claypan 12-16"	USC	1982	--	--
80-27	L. Slope 10-16"	USC	1982	--	--
81-01	Claypan 10-12"	MMC	1981	1984	--
81-02	Loamy 10-12"	UMC	1981	1985	--
81-03	Loamy 10-12"	UMC	1981	1985	--
81-04	Claypan 10-12"	MMC	1981	1984	--
81-05	Loamy 8-10"	MMC	1981	1984	--
81-06	Loamy 10-12"	MMC	1981	1984	--
81-07	Claypan 10-12"	MMC	1981	1984	--
81-08	L. Slope 10-16"	UMC	1981	1985	--
81-09	L. Slope 10-16"	UMC	1981	1985	--
81-10	L. Slope 10-16"	UMC	1981	1985	--
82-01	Loamy 8-10"	LMC	1982	1984	--
82-02	Claypan 10-12"	MC	1982	1984	--
82-03	Loamy 10-12"	MC	1982	1984	--
82-05	Loamy 8-10"	MC	1982	1984	--
82-06	Loamy 10-12"	MC	1982	1984	--
82-07	Claypan 10-12"	MC	1982	1984	--
82-08	Loamy 10-12"	MC	1982	1984	--
82-09	Claypan 10-12"	MC	1982	1984	--
82-10	Loamy 10-12"	UMC	1982	1985	--
82-11	Claypan 10-12"	UMC	1982	1985	--
82-12	Loamy 10-12"	UMC	1982	1985	--
82-13	Loamy 8-10"	UMC	1982	1985	--
82-18	Claypan 10-12"	UMC	1982	1985	--
82-19	Claypan 10-12"	LMC	1982	1984	--

Table 3.2. cont.

83-07	Loamy 8-10"	USC	1983	--	--
83-08	Loamy 10-12"	MMC	1983	1984	--
84-03	Claypan 12-16"	MC	1984	--	--

Pasture Key: USC = Upper Sheep Creek
UMC = Upper Mahala Creek
MMC = Middle Mahala Creek
LMC = Lower Mahala Creek
MC = Mahala Control

3.3. National Forest native pastures:

Plot number	Range site name	Pasture*	Year of first sample	Year of second sample	Year of third sample
79-03	Mtn. Ridge 16+"	NNF	1985	--	--
79-04	Claypan 12-16"	NNF	1985	--	--
79-05	Mtn. Ridge 16+"	SNF	1981	--	--
79-06	Mtn. Ridge 16+"	NNF	1985	--	--
79-09	S. Slope 12-14"	SNF	1981	--	--
79-10	L. Slope 10-16"	NNF	1985	--	--
79-13	L. Slope 10-16"	SNF	1981		-
79-14	L.Slope 10-16"	NNF	1985	--	--
79-20	Aspen thicket 16+"	SNF	--	--	--
79-21	Aspen woodland	SNF	1981	--	--
79-22	Riparian aspen	SNF	1981	--	--
79-23	L. Slope 16+"	NNF	1985	--	--
79-24	Steep N. Slope 16+"	SNF	1981	--	--
79-25	Steep N. Slope 16+"	NNF	1985	--	--
79-26	Aspen thicket	NNF	--	--	--
79-28	Steep N. Slope 16+"	NNF	1985	--	--
80-28	Claypan 12-16"	NNF	1985	--	--
80-29	Claypan 12-16"	NNF	1985	--	--
80-30	S. Slope 14-18"	NNF	1985	--	--
80-31	Mtn. Ridge 16+"	NNF	1985	--	--
80-32	S. Slope 14-18"	NNF	1985	--	--
80-33	Claypan 12-16"	NNF	1985	--	--
80-34	S. Slope 12-14"	NNF	1985	--	--
80-35	Riparian Aspen	NNF	1985	--	--
80-36	S. Slope 14-18"	NNF	1985	--	--
80-37	Aspen Woodland	NNF	1985	--	--
80-38	L. Slope 16+"	NNF	1985	--	--
80-39	S. Slope 12-14"	NNF	1985	--	--
81-13	Riparian Aspen	SNF	1981	--	--
81-15	Aspen Woodland	SNF	1981	--	--
81-16	S. Slope 14-18"	SNF	1981	--	--
81-17	S. Slope 14-18"	SNF	1981	--	--
81-18	Claypan 12-16"	SNF	1981	--	--
81-19	Aspen Woodland	SNF	1981	--	--
81-20	S. Slope 12-14"	SNF	1981	--	--
81-21	S. Slope 12-14"	SNF	1981	--	--
81-22	S. Slope 12-14"	SNF	1981	--	--
81-23	L. Slope 16+"	SNF	1981	--	--

Table 3.2 cont.

81-24	Aspen Woodland	SNF	1981	—	—
81-25	Claypan 12-16"	SNF	1981	—	—
81-26	S. Slope 12-14"	SNF	1981	—	—
82-21	L. Slope 10-16"	NNF	1982	1985	—
83-09	Riparian Aspen	NNF	1983	1985	—
83-10	S. Slope 12-14"	NNF	1983	1985	—
83-11	L. Slope 16+"	NNF	1983	1985	—

Pasture Key: NNF = North National Forest
SNF = South National Forest

UTILIZATION SUMMARY

1980 through 1985 Objective:

Estimate species utilization on major range sites at the end of respective grazing periods and at the end of the growing season.

1980 through 1985 Accomplishments:

Methods. The "Key Forage Plant Method" (BLM, 1984) was used to estimate forage utilization at the end of the grazing and growing seasons on monitoring plots and other sample areas of range sites in pastures on the Saval Allotment. These estimates were used to indicate cattle preferences among range sites, changes in species and range site preferences over the grazing season, differences in species and range site preferences among years, and the possible impact of grazing on plants as indicated by residual use at the end of the growing season.

Results. Three grazing systems were described in the Saval Coordinated Management Plan (BLM, 1981). However, grazing on the allotment from 1980 through 1985 occurred under an interim schedule in preparation for starting the Coordinated Management System. Even though grazing during this period did not occur exactly as described in the Management Plan, utilization information will be grouped and discussed in relation to the proposed grazing systems.

A. 3-Pasture Deferred-Rotation. The East Darling (ED), West Darling (WD), and Lower Sheep Creek (LSC) Pastures are grazed under this system. These are BLM Pastures that have been seeded to crested wheatgrass (ED and WD) or to a mixture of crested wheatgrass and other grass and forb species (LSC). The grazing plan schedules use in one of these three pastures each year during the early phenologic growth stage of crested wheatgrass (April 15 to May 8). Grazing crested wheatgrass during this early stage reduces root growth but, in most years, there is still adequate soil moisture for regrowth after herbage removal. Regrowth permits some recovery of the plant's root system and carbohydrate reserves. The following year, the early-use pasture is not grazed during the growing season, but in the fall (October or November), in order to increase plant vigor, root development and establishment of new plants. The late spring grazing treatment (May 8 to May 31) allows for partial completion of root growth and increased plant vigor before grazing. Some regrowth is expected to occur after this grazing period except in very dry years. This grazing period is perhaps the most detrimental to grass plants in dry years because little or no regrowth occurs and therefore root reserves are not replenished. Because this grazing period occurs after the fall grazing period in the preceding year, plant vigor should be maximum before late spring grazing begins.

Table 3.3 presents utilization levels on range sites and seedings in the seeded BLM Pastures from 1981 through 1985. Table 3.4 presents utilization levels on native species on various range sites and on seeded species in seeded BLM pastures. There are no utilization records for these pastures in 1980 because use occurred before utilization studies were initiated. Fall utilization data are also not available for 1983 and 1984. Cattle were not moved out of the fall-use pastures until snow covered the plants. It was not possible to estimate grazing use under this condition.

Table 3.3. Vegetation utilization by cattle of range sites in the BLM seeded pastures of the Saval Allotment for the 1981 through 1985 grazing seasons.

Range Site	1981 (Rest)[1]	1982 (4/16-5/6)	1983 (4/16-5/2)	1984 (11/1-12/3)	1985 (4/18-5/7)
East Darling Pasture					
Claypan 10-12"	0[2]	-[3]	-	-	3-
Loamy 8-10"	0	-	-	-	4-
Seeded	0	5	2+	-	4
West Darling Pasture					
	(Rest)	(5/1-5/10)	(Rest)	(5/16-6/4)	(5/8-5/30)
Wet Meadow 10-16"	0	5	0	3+	5+
Claypan 10-12"	0	-	0	1	3
Loamy 8-10"	0	-	0	2-	4-
Seeded	0	5-	0	4-	4+
Lower Sheep Creek Pasture					
	(4/1-5/16)	(Rest)	(10/1-11/16)	(4/23-5/15)	(Rest)
Loamy Bottom 8-14"	5	0	-	1+	0
Wet Meadow 10-16"	5	0	-	-	0
Claypan 10-12"	3	0	-	1-	0
Loamy 8-10"	3	0	-	1	0
Seeded	-[4]	0	-	4-	0
Darling Control Pasture					
	(Rest)	(5/19-6/26)	(6/4-9/9)	(6/18-7/18)	(4/23-5/30)
Seeded	0	-	-	4-	2

[1] Grazing period.

[2] Utilization classes:
0 = No use = 0%
1 = Slight = 1-20%
2 = Light = 21-40%
3 = Moderate = 41-60%
4 = Heavy = 61-80%
5 = Severe = 81-100%
+ or - indicates use was at high or low end of class

[3] No use estimate recorded.

[4] Range site not present.

* Pasture was plowed and seeded in fall of 1981.

Table 3.4. Utilization by cattle of common species to the BLM seeded pastures of the Saval Allotment for the 1981 through 1985 grazing seasons.

Species	1981 (Rest)[1]	1982 (4/16-5/6)	1983 (4/16-5/2)	1984 (11/1-12/3)	1985 (4/18-5/7)
East Darling Pasture					
Crested wheatgrass	0[2]	5	2+	-	4
Sandberg bluegrass	0	-[3]	5	-	3
Bottlebrush squirreltail	0	-	-	-	1
Thurber needlegrass	0	-	-	-	4
Webber ricegrass	0	-	-	-	3+
West Darling Pasture					
	(Rest)	(5/1-5/10)	(Rest)	(5/16-6/4)	(5/8-5/30)
Crested wheatgrass	0	5-	0	4-	4+
Sandberg bluegrass	0	5-	0	2-	3-
Bottlebrush squirreltail	0	-	0	1-	1+
Thurber needlegrass	0	-	0	2-	4
Nevada bluegrass	0	5	0	4	5
Sedge sp.	0	5	0	3	5
Juncus sp.	0	5	0	3	5
Lower Sheep Creek Pasture					
	(4/1-5/16)	(Rest)	(10/1-11/16)	(4/23-5/15)	(Rest)
Crested wheatgrass	x[4]	0	-	4	0
Sandberg bluegrass	3	0	-	2	0
Bottlebrush squirreltail	3	0	-	1-	0
Webber ricegrass	4	0	-	1	0
Nevada bluegrass	5	0	-	2-	0
Sedges sp.	5	0	-	0	0
Juncus sp.	5	0	-	0	0
Darling Control Pasture					
	(Rest)	(5/19-6/26)	(6/4-9/9)	(6/18-7/18)	(4/23-5/30)
Crested wheatgrass	0	-	-	4	2
Sandberg bluegrass	0	-	-	1-	2-

[1] Grazing Period
[2] See Table 3.3 for utilization classes
[3] Utilization estimate no recorded
[4] Not present in 1981

1981. The LSC Pasture was not seeded until fall 1981. The first utilization records are for the native vegetation existing in this pasture in April 1981. Since the pasture was scheduled to be plowed and seeded during the fall, it was grazed heavily in the spring (April 1 to May 16) to use all available forage before treatment. This grazing schedule provided an opportunity to rest existing seeded pastures that normally are grazing during this time. Overall use on the LSC Pasture was moderate (41-60%). All of the old forage that had accumulated during 1980 when the pasture was rested was grazed, as was the 1981 spring growth. Use of infrequent species such as sedge, rush, and Nevada bluegrass on Loamy Bottom 8-14" and Wet Meadow 10-16" Range Sites was severe (81-100%). On the Loamy 8-10" and Claypan 10-12" Range Sites, utilization of the more common species was heavy (61-80%) on Webber ricegrass and moderate on Sandberg bluegrass and bottlebrush squirreltail. Most species grazed during this time were in early leaf phenology stage. Sandberg bluegrass, which develops earlier than most other grasses, was in early leaf to bloom phenology stages. Cattle were moved out of this pasture in time for grasses to regrow and set seed.

1982. Cattle grazed the ED Pasture from April 16 to May 6. They were allowed to drift into the WD Pasture starting May 1. All cows were moved into the WD by May 6 where they grazed until about May 10. Use in both pastures was severe at the end of the grazing period. Crested wheatgrass in early leaf stage was the primary species grazed. Spring 1982 was very cold and plant growth on wheatgrass seedings was slow during the entire grazing period. When cows entered the ED, only 39 lb/ac of forage was available (1982 Saval Production Data). By comparison on April 23, 1981, 106 lb/ac of crested wheatgrass forage had been produced (1981 Saval Production Data). Severe utilization in 1982 was due to the small amounts of forage available during the grazing period. After the cattle were moved from the pastures, the weather warmed up and, with abundant soil moisture, regrowth was excellent. By July, these pastures showed no sign of early spring grazing.

1983. Cows grazed the ED Pasture from April 15 to May 2. Use was light (21-40%) at the end of the grazing period. Crested wheatgrass in early leaf was the primary species grazed. Use on the ED and WD Pastures in 1982 was severe after grazing at about the same time as in 1983. Lighter use in 1983 was due to better forage production and to a reduction in the Saval cow herd from 972 to 659 animals. Only 396 AUM's of forage were taken from the ED Pasture compared to 1040 AUM's taken from the ED and WD Pastures in 1982 (BLM actual use records). This was a 62% reduction in grazing use. In both years, regrowth and seed production by crested wheatgrass after grazing were excellent due to abundant soil moisture. Due to this regrowth, utilization at the end of the growing season was slight.

1984. The LSC and WD Pastures were grazed by the main Saval cow herd from April 23 to May 15 and from May 16 to June 4, respectively. Use was in the heavy class on seeded areas of both pastures at the end of the grazing period. However, actual utilization was 60-65% (low end of the heavy class). This is proper use for crested wheatgrass seedings, because utilization tends to be even throughout the pasture and "wolfplant" development is reduced. Unseeded range sites in both pastures received slight (1-20%) to light use except the Wet Meadow 10-16" Range Site in the WD Pasture which received moderate use. Crested wheatgrass in early leaf was the primary

species grazed in both pastures. Wet meadow species (Nevada bluegrass, sedges, and rushes) received moderate to heavy use. Regrowth and seed production by crested wheatgrass and wet meadow species was excellent due to another wet year. Due to this regrowth, utilization at the end of the 1984 growing season was slight.

1985. The ED and WD Pastures were grazed from April 18 to May 7 and from May 8 to May 30, respectively. Use was heavy on seeded and Loamy 8-10" areas and moderate on Claypan 10-12" areas in both pastures at the end of the grazing period. In the WD Pasture use was severe on the Wet Meadow 10-16" Range Site (this range site does not occur in the ED pasture) and on the wet meadow species (Nevada bluegrass, sedges, and rushes). These species comprise only a small portion of the cattle's diet since only a small area of wet meadow occurs in this pasture. Meadow plants were in early leaf during the grazing period and were able to regrow and set seed after grazing. Thurber needlegrass received heavy use but is an infrequent species in both pastures. Webber's ricegrass received moderate use in the ED Pasture while Sandberg bluegrass was grazed moderately in both pastures. Use on these three species was higher than it had been during the same grazing period in 1984. Cattle utilization of these three species was greater in 1985 because 1985 was a much drier year than 1984 and crested wheatgrass was not as productive. Crested wheatgrass was in early leaf in the ED Pasture and early leaf to boot stage in the WD Pasture during respective grazing periods. Use in both pastures exceeded the proper use level of 60-65% (low end of the heavy class) for crested wheatgrass. Since 1985 was a very dry year, plants in the WD Pasture were not able to regrow and set seed after the late grazing period as they had in previous years. Due to lack of regrowth, utilization at the end of the growing season was heavy. Crested wheatgrass in the ED Pasture was able to produce some regrowth so utilization at the end of the growing season was moderate.

Darling Control. In addition to the seeded pastures already mentioned, there is a fourth seeded pasture known as the Darling Control (DC) Pasture. This pasture was established to function as a research control pasture for comparing grazing under the traditional season-long system (April 15 through May 31) to the new deferred-rotation system.

The Darling Control Pasture was never grazed during the prescribed period of April 15 through May 31. In 1982 it was grazed from May 19 through June 26 when crested wheatgrass was in early leaf to prebloom phenology stages. Grazing continued late enough so that little regrowth occurred. Grazing in 1983 was even later, June 4 through September 9. Crested wheatgrass matured from prebloom phenology through seed ripe to seed cast stages during this time. The pasture was used as a catch-all pasture in 1982 and 1983 for cull cows and miscellaneous animals. No use estimates were recorded in 1982 and 1983.

In 1984, the Darling Control Pasture was grazed by yearlings from mid-June to mid-July. Crested wheatgrass in the prebloom and bloom phenology stages received heavy use during this period. Little regrowth occurred and use measured at the end of the growing season was moderate. Yearlings also grazed this pasture in 1985 from April 23 through May 30, fairly close to the

prescribed grazing period. Crested wheatgrass was in early leaf during the grazing period and received light use. Plants regrew and set some seed after grazing. Therefore, use measured at the end of the growing season was slight.

Summary. Under the Saval Management Plan, grazing of seeded pastures at the proper use level of 60-65% occurs early enough in the season so that in most years seeded grasses on both the early- and deferred-use pastures will regrow and set seed. Even when proper use is exceeded during a grazing period, there is enough soil moisture after grazing in most years so that plants will regrow and set seed. In only one year out of the past five were crested wheatgrass plants unable to regrow after the late (May 8 to May 31) grazing period. In all years, some regrowth was possible after the early (April 15 to May 8) grazing period.

Crested wheatgrass and other seeded species are the primary species utilized when cattle graze these seeded pastures. However, native species found within the seeded areas or on unseeded areas within the seeded pastures, are also utilized by cattle.

B. 3-Pasture Rest-Rotation. The Upper Sheep Creek (USC), Upper Mahala Creek (UMC), and Middle Mahala Creek (MMC) Pastures are grazed under this system. These are BLM pastures with native vegetation. The grazing plan schedules grazing in one of these pastures each year during the early phenologic stages of native grasses (June 1 through June 15). Grazing during this time reduces plant vigor and cover for watershed protection. After grazing, rest during the summer and fall allows plants to replenish some carbohydrate reserves, prevents grazing pressure on browse species that would occur with late fall grazing, and allows for some sage grouse nesting cover for the next breeding season. The following year the early-use pasture is grazed from June 16 through June 30. This deferment of grazing on native grasses increases plant vigor due to root growth and a higher concentration of root carbohydrates before grazing. Summer and fall rest after this grazing period is expected to provide similar benefits to the early-use grazing treatment. In the third year, the pasture is rested completely. This allows for seed set and possible seedling establishment. Litter accumulation and plant vigor is increased. Also, residual cover for sage grouse nesting habitat is provided for the next year.

In addition to the three BLM native pastures mentioned above, there is also the Lower Mahala Creek (LMC) Pasture. This pasture has a limited amount of forage and is not part of any grazing system. Generally, it has been used for emergency situations or in conjunction with the MMC Pasture.

Table 3.5 and 3.6 presents utilization levels by range sites, and by species, respectively, on native BLM pastures from 1981 through 1985. There are no utilization records for these pastures in 1980. Use occurred before utilization studies were initiated.

1981. Cattle grazed the USC Pasture from May 17 through May 31. Utilization was slight to light on all the range sites sampled with the Wet Meadow 10-16", Loamy Bottom 8-14", and Loamy 8-10" Range Sites receiving the most use. Two of the most preferred forage species (Nevada bluegrass and sedge) are common on the Wet Meadow 10-16" and Loamy Bottom 8-14" Range Sites and received moderate use. Two other preferred species (Thurber needlegrass and Webber

Table 3.5. Vegetation utilization by cattle of range sites in the BLM native pastures of the Saval Allotment for the 1981 through 1985 grazing seasons.

Range Site	1981 (Rest)[1]	1982 (5/27-6/24)	1983 (5/20-7/1)	1984 (6/23-7/9)	1985 (Rest)
Upper Sheep Creek Pasture					
Loamy Bottom 8-14"	2+	3-	1	1-	0
Wet Meadow 10-16"	2+	3	3+	1	0
Loamy Slope 10-16"	1+	3-	3	3-	0
Loamy 10-12"	2-	3-	2	2	0
Claypan 12-16"	1-	2-	2-	1-	0
Claypan 10-12"	2-	3-	1	1-	0
Loamy 8-10"	2+	3	1	1-	0
Upper Mahala Creek Pasture					
	(Rest)	(Rest)	(5/20-7/1)	(6/5-6/22)	(Rest)
Wet Meadow 10-16"	0[2]	0	2-	1	0
Loamy Slope 10-16"	0	0	1	3	0
Loamy 10-12"	0	0	1-	3+	0
Claypan 10-12"	0	0	1-	2	0
Loamy 8-10"	0	0	0	1-	0
Middle Mahala Creek Pasture					
	(Rest)	(5/11-5/25)	5/9-5/26)	(Rest)	(Rest)
Loamy Bottom 8-14"	0	-[3]	1-	0	0
Wet Meadow 10-16"	0	3	3	0	0
Loamy 10-12"	0	3-	3-	0	0
Claypan 10-12"	0	2+	2	0	0
Loamy 8-10"	0	2	3	0	0
Lower Mahala Creek Pasture					
	(Rest)	(5/7-5/24)	(5/4-5/9)	(Rest)	(Rest)
Loamy Bottom 8-14"	0	1+	3	0	0
Loamy 10-12"	0	3	3+	0	0
Claypan 10-12"	0	2+	3-	0	0
Loamy 8-10"	0	2-	1+	0	0
Mahala Control Pasture					
	(Rest)	(Rest)	(Rest)	(7/19-8/13)	(Rest)
Wet Meadow 10-16"	0	0	0	4+	0
Dry Meadow 10-16"	0	0	0	5-	0
Claypan 12-16"	0	0	0	3-	0
Claypan 10-12"	0	0	0	3-	0
Loamy 10-12"	0	0	0	3+	0
Loamy 8-10"	0	0	0	3	0

[1] Grazing period
[2] See Table 3.3 for utilization classes
[3] No use estimate recorded

Table 3.6. Utilization by cattle of species common to the BLM native pastures of the Saval Allotment for the 1981 through 1985 grazing seasons.

Species	1981 (5/17-5/31)[1]	1982 (5/27-6/24)	1983 (5/20-7/1)	1984 (6/23-7/9)	1985 (Rest)
		Upper Sheep Creek Pasture			
Nevada bluegrass	3-[2]	3+	2+	1+	0
Sedge sp.	3	2	1	1-	0
Juncus sp.	1+	2	4	0	0
Spike fescue	-[3]	4	5	2-	0
Great Basin wildrye	1	2	2+	2	0
Bluebunch wheatgrass	2-	2	1+	1+	0
Idaho fescue	2-	2	1	2-	0
Thurber needlegrass	3-	2+	2-	1-	0
Webber ricegrass	3-	2	1+	1-	0
Sandberg bluegrass	1+	3+	1	1-	0
Bottlebrush squirreltail	1+	2	1+	1-	0
Antelope bitterbrush	-	0	1	0	0
		Upper Mahala Creek Pasture			
	(Rest)	(Rest)	(5/20-7/1)	6/5-6/22)	(Rest)
Nevada bluegrass	0	0	2-	2-	0
Sedge sp.	0	0	1+	1	0
Juncus sp.	0	0	1+	0	0
Great Basin wildrye	0	0	2+	1	0
Bluebunch wheatgrass	0	0	1-	2-	0
Idaho fescue	0	0	0	1-	0
Thurber needlegrass	0	0	1	1	0
Webber ricegrass	0	0	-	1-	0
Sandberg bluegrass	0	0	1-	3+	0
Bottlebrush squirreltail	0	0	1+	1-	0
Antelope bitterbrush	0	0	0	0	0
		Middle Mahala Creek Pasture			
	(Rest)	(5/11-5/25)	(5/9-5/26)	(Rest)	(Rest)
Nevada bluegrass	0	4	4-	0	0
Sedge sp.	0	1	3	0	0
Juncus sp.	0	2	2+	0	0
Great Basin wildrye	0	0	1	0	0
Thurber needlegrass	0	3	0	0	0
Webber ricegrass	0	3-	1+	0	0
Sandberg bluegrass	0	3	3+	0	0
Bottlebrush squirreltail	0	2-	1-	0	0

Table 3.6 (continued)

	Lower Mahala Creek Pasture				
	(Rest)[1]	(5/7-5/24)	(5/4-5/9)	(Rest)	(Rest)
Nevada bluegrass	0	-	4	0	0
Sedge sp.	0	1-	1	0	0
Great Basin wildrye	0	1-	0	0	0
Thurber needlegrass	0	2	1+	0	0
Webber ricegrass	0	2	1+	0	0
Sandberg bluegrass	0	1+	1-	0	0
Bottlebrush squirreltail	0	1+	1-	0	0

	Mahala Control Pasture				
	(Rest)	(Rest)	(Rest)	(7/19-8/13)	(Rest)
Nevada bluegrass	0	0	0	4-	0
Sedge sp.	0	0	0	4+	0
Rush sp.	0	0	0	5-	0
Great Basin wildrye	0	0	0	3+	0
Bluebunch wheatgrass	0	0	0	2+	0
Idaho fescue	0	0	0	3	0
Thurber needlegrass	0	0	0	3+	0
Webber ricegrass	0	0	0	4	0
Sandberg bluegrass	0	0	0	0	0
Bottlebrush squirreltail	0	0	0	3	0
Antelope bitterbrush	0	0	0	4-	0

[1] Grazing period
[2] See Table 3.3 for utilization classes
[3] Utilization estimate not recorded

ricegrass) occur on the loamy and claypan range sites which make up the majority of the vegetation within the pasture. The Loamy 8-10" Range Site is located along the lower or eastern portion of the pasture. Since this is where the cattle were turned in, use was heaviest in this area. If the grazing period had been longer, more cattle would have drifted west, up the pasture, and use would have been more evenly distributed. Topography in this pasture is fairly gentle and would have had little effect on cattle distribution.

1982. The LMC and MMC Pastures were grazed from May 7 through May 25. Use was light to moderate on most range sites. Sandberg bluegrass, a common species in these pastures, was the most preferred upland grass and received moderate use. Webber ricegrass and Thurber needlegrass are less common, but also were preferred at this time. Nevada bluegrass on wet meadows also received moderate use, but made up only a small part of the cattle's diet since very few meadows occur in the LMC and MMC Pastures. This species was in early leaf during the grazing period. Sandberg bluegrass is one of the earliest developing grasses on the Saval Allotment and reached the flowering stage while cows were in these pastures. Ricegrass and needlegrass are also early maturing species, but only reached the prebloom stage during this time.

From May 25 to June 24, cattle grazed the USC Pasture. Use was moderate on all sites except use was light on the Claypan 12-16" Range Site. In 1981, this claypan site was also the least preferred site. Nevada bluegrass received moderate use in wet meadows which contain only a very small portion of this pasture's forage. Other meadow species received light use. Sandberg bluegrass, a common species in the pasture, was still preferred during this grazing period and received moderate use. Spike fescue, an infrequent species in the pasture, received heavy use. Thurber needlegrass and Webber ricegrass received light use, as did bottlebrush squirreltail, Great Basin wildrye, bluebunch wheatgrass, and Idaho fescue. In 1981, Thurber needlegrass and Webber ricegrass were preferred over Sandberg bluegrass. Spring was drier and warmer in 1981 than in 1982, so the bluegrass probably matured sooner and was less palatable to cattle in 1981. Needlegrass and ricegrass mature slightly later than bluegrass and were probably still palatable when cows grazed the pasture in 1981.

1983. The LMC Pasture was grazed from May 4 through May 9. Use was moderate on all sites except on the Loamy 8-10" Range Site which received slight use. From May 10 to May 26, cattle grazed the MMC Pasture. Use was slight on the Loamy Bottom 8-14" Range Site, light on the Claypan 10-12" Range Site, and moderate on all other range sites. Nevada bluegrass on Wet Meadow 10-16" and Loamy Bottom 8-14" Range Sites received heavy use in both pastures. Sedges and rushes had moderate use in the MMC pasture. These three meadow species comprise only a small part of the cattle diet in these lower pastures, because the wet meadows in which they grow are rare. Sandberg bluegrass, a common upland species in both pastures, received moderate use.

About 125 cows (mostly replacement heifers) grazed the UMC Pasture from late May to the end of June. Use of range sites in this pasture was slight, except use was light on the Wet Meadow 10-16" Range Site. Great Basin wildrye and Nevada bluegrass in early leaf to bloom phenology stages were the most utilized species.

From mid-May to the end of June, most of the cow herd grazed the USC Pasture. The wet Meadow 10-16" Range Site received moderate use, while the Loamy 10-12" and Claypan 12-16" Range Sites received light use. Use on other range sites was slight. Spike fescue, an infrequent species in the USC Pasture, was severely utilized during this grazing period. Rushes, Nevada bluegrass, Great Basin wildrye, and Thurber needlegrass received light to moderate use. These species were in early leaf to bloom phenology stages during the grazing period. Moderate use and some regrowth after grazing on all Mahala Pastures and on the USC Pasture resulted in slight to moderate use on most species as measured at the end of the growing season. The exception was spike fescue in the USC Pasture. Use was severe on this species, and little or no regrowth occurred after grazing.

1984. The UMC Pasture was grazed from June 5 to June 22. Use was moderate on the Loamy 10-12" and Loamy Slope 10-16" Range Sites. Use on all other sites was slight to light. From June 23 to July 9, cattle grazed the USC Pasture. Use was moderate on the Loamy Slope 10-16" Range Site and slight to light on all other range sites. Sandberg bluegrass, a common upland species in both pastures, received moderate use in the UMC Pasture while it was in early leaf to prebloom phenology. In the USC Pasture, it received very little use when in bloom to seedripe phenology stages. Use on all other species was slight to light in both pastures. During June and early July, most forage species in the UMC and USC Pastures matured from early leaf or prebloom phenology stages to peak bloom or seedripe stages. Light grazing and some regrowth after grazing on both UMC and USC Pastures resulted in slight use and no harmful effects on most species at the end of the growing season.

1985. No systematic grazing of BLM native pastures occurred this year.

Mahala Control. The Mahala Control (MC) Pasture, like the DC pasture, was established to function as a research control pasture for comparing grazing under the traditional season-long system (June 1 through June 30) to the new rest-rotation system.

The MC Pasture was not grazed during the prescribed period of June 1 through June 30. In 1981, 1982, 1983, and 1985 it did not receive any grazing use. In 1984, it was grazed by yearlings from July 19 through August 13. Use on the Wet Meadow 10-16" and Dry Meadow 10-16" Range Sites was heavy and severe, respectively, and moderate on all other range sites. Meadow species in bloom to seedripe phenology stages received heavy to severe use. Webber ricegrass and antelope bitterbrush in seedripe to seed-dissemination phenology stages also received heavy use. Sandberg bluegrass was mature and dry during this period and was not grazed. All other species in this pasture received moderate use. No regrowth occurred after yearlings were removed so use levels at the end of the growing season were the same as at the end of the grazing period.

Summary. Under the Saval Management Plan, grazing of BLM native pastures occurs when most native grasses are in early leaf to bloom phenology stages. Grazing grasses during these phenology stages is beneficial to cattle but detrimental to plants. When phenology approaches bloom stage, plants are productive and herbage is ideally balanced in minerals, vitamins, proteins, carbohydrates, roughage, and moisture for livestock gain. However, grazing can be harmful to plants when carbohydrate reserves are at a minimum and when

Table 3.8. Utilization by cattle of common species in the National Forest Pastures of the Saval Allotment for the 1980 through 1985 grazing seasons.

Species	1980 (6/15-8/15)[1]	1981 (7/28-9/20)	1982 (6/24-8/1)	1983 (7/1-8/16)	1984 (9/1-9/30)	1985 (6/21-8/14)
South National Forest Pasture						
Nevada and Kentucky bluegrass	4+[2]	4+	4+	4-	4-	5-
Sedge sp.	5	4	3+	4-	3+	5-
Rush sp.	3	3+	3+	4-	3	5-
Spike fescue	3	1+	3	3-	1	3
Great Basin wildrye	2	2-	3	2+	1+	2+
Bluebunch wheatgrass	1+	1+	3-	2-	1	2+
Idaho fescue	1+	1-	2-	1+	1-	1
Needlegrass sp.	-[3]	-	2-	1-	1	3-
Mountain brome	-	0	1+	0	1	1+
Sandberg bluegrass	-	0	0	0	1	0
Bottlebrush squirreltail	-	1-	0	1	0	0
Antelope bitterbrush	-	3	4-	3	1+	2+
North National Forest Pasture	(8/15-9/30)	(6/1-7/27)	(7/29-9/30)	(8/16-9/30)	(7/10-8/31)	(8/15-9/30)
Nevada and Kentucky bluegrass	4-	5	4-	3+	4-	4
Sedge sp.	4-	4+	3-	3+	4-	4+
Rush sp.	3	3+	4-	3+	3+	3+
Spike fescue	3	3+	4-	1+	2+	1+
Great Basin wildrye	2	3	2	1	2-	1-
Bluebunch wheatgrass	2	2+	2-	1+	2-	2
Idaho fescue	2+	3	2+	1+	1+	3+
Needlegrass sp.	-	-	1-	1-	1+	0
Mountain brome	-	1	1-	1-	0	0
Sandberg bluegrass	-	1	1-	1	0	0
Bottlebrush squirreltail	-	1	0	0	0	0
Antelope bitterbrush	-	3	1+	2	1+	3

[1] Grazing period
[2] See Table 3.3 for utilization classes.
[3] Utilization estimate not recorded.

again received moderate use. Use on all other range sites in the pasture was slight to light. Generally, late summer use was less on Wet Meadow 10-16", Riparian Aspen, and Aspen Woodland Range Sites than on the same sites in early summer. Wet meadow species (Nevada and Kentucky bluegrasses, sedges and rushes) were moderately to severely grazed in both pastures. Spike fescue, an infrequent upland grass, received moderate use in both pastures. Idaho fescue and bluebunch wheatgrass were more heavily grazed in the late-use pasture than in the early-use pasture. In mid-September, these last two species greened up due to about an inch of precipitation from late summer storms. Most other upland species were dry and cured by September, so this greenup was very attractive to cattle. Use on Great Basin wildrye was light throughout the summer. Other grass species in the sample were Sandberg bluegrass, mountain brome, and bottlebrush squirreltail. These species were common on many range sites, but were unused or had only very slight use.

1981. At the end of the early-grazing period on the NNF Pasture (June 1 to July 27), the Wet Meadow 10-16", Riparian Aspen and Aspen Woodland Range Sites had been severely utilized. The Dry Meadow 10-16", South Slope 14-18", and Loamy Slope 10-16" Range Sites had received heavy use, while use on the Loamy Slope 16+" and South Slope 12-14" Range Sites was moderate. Preferred species during this grazing period were Kentucky and Nevada bluegrasses and sedges. All these species are found on meadow or aspen range sites. The least preferred species during this period were mountain brome, Sandberg bluegrass, and bottlebrush squirreltail.

When the SNF Pasture was grazed during late summer, the Wet and Dry Meadow 10-16" Range Sites received severe use while the Riparian Aspen and Loamy Slope 10-16" Range Sites were heavily used. Use on most of the other range sites was lighter than it had been on the same range sites in the NNF. Preferred species in the SNF during late summer were those found on meadow and aspen sites: Kentucky and Nevada bluegrasses and sedges. Mountain brome, Sandberg bluegrass, and bottlebrush squirreltail were again the least preferred forage species. Use of most grasses was lower in the SNF Pasture than it had been in the NNF Pasture. In 1980, use on bluebunch wheatgrass and Idaho fescue was higher in late than in early summer. An increase in use on these species was not observed in 1981, probably because no fall greenup occurred as it had in 1980. Antelope bitterbrush received moderate use in both pastures. Cattle do not normally use bitterbrush until late summer or fall. Use of bitterbrush in the early summer may be a reflection of the heavy utilization of preferred herbaceous species. A lack of preferred herbaceous species may have caused an earlier than normal use of bitterbrush.

1982. Cattle grazed the SNF Pasture from June 24 until August 1. Starting in late July and continuing through August, most of the herd was moved into the NNF Pasture where grazing continued until the end of September. Use on the Wet Meadow 10-16", Dry Meadow 10-16", and South Slope 14-18" Range Sites was heavy to severe in the early-use pasture. The Riparian Aspen, South Slope 12-14", Loamy Slope 10-16", and Aspen Woodland Range Sites were also preferred sites in this pasture and received heavy use. In the late-use pasture, use was moderate to heavy on the Wet Meadow 10-16" Range Site and slight to light on all other range sites.

In 1981, the California Creek drainage of the NNF received heavier use than the rest of the pasture due to a shortage of water in other pastures. During

the late summer 1982, very few cows grazed this drainage until early September with resulting lighter use than in the rest of the pasture. The area was abused in 1981, but recovered well in 1982 due to late grazing, good growing season, and moderate utilization.

Heavily used, preferred species in the early-use pasture (SNF) were meadow bluegrasses and antelope bitterbrush. Other preferred species during the same period were sedges, rushes, spike fescue, Great Basin wildrye, and bluebunch wheatgrass. Most grasses in this pasture were in prebloom or bloom phenology stages when cattle were turned in, and either reached seedripe or shed their seeds by the end of the early summer grazing period. Use on most of the same species in the late-use pasture (NNF) was about the same or lower than in the SNF. However, use on rushes, spike fescue, and Idaho fescue was higher than in the SNF. Spike fescue is very palatable to cattle even after seed is cast and forage is dry. Other grasses were less palatable after seeds are cast. Heavy use on bitterbrush during early summer on the SNF may be a reflection of high utilization of preferred herbaceous species that resulted in an earlier than expected use of bitterbrush. Usually cattle increase their use of bitterbrush late in the season as grasses mature and quality declines. Low use on bitterbrush in the late summer pasture was unexpected.

1983. Cattle were moved onto the SNF Pasture July 1. In mid-August, most of the herd was moved into the NNF Pasture, where grazing continued until early October. Use on the Riparian Aspen, Wet Meadow 10-16", and Dry Meadow 10-16" Range Sites was heavy to severe in the early-use pasture. The South Slope 14-18", Claypan 12-16", and Loamy Slope 10-16" Range Sites received moderate use. Use at the end of the grazing period in the late-use pasture was heavy on the Wet Meadow 10-16" and light on the Riparian Aspen Range Sites.

Generally, utilization on range sites in the early summer-use pasture was higher than on the same range sites in the late summer-use pasture. Utilization in the late summer-use pasture was lighter in 1983 than in 1982. The lower utilization was probably due to both a reduction in herd size and an increase in forage production in 1983.

The most heavily grazed species in the SNF were meadow bluegrasses, mostly Kentucky. Other species used during the same period were antelope bitterbrush, spike fescue, sedges, rushes, Great Basin wildrye, and bluebunch wheatgrass. Most grasses in the SNF were in prebloom or bloom stages when cattle were turned in on July 1, and either reached seedripe or cast seed by the end of the early summer-grazing period. In the NNF, use on the above species was lower than in the SNF. Use on meadow bluegrasses was highest of all species grazed. Grasses were mature (seedripe) or had already cast their seeds when cattle moved to this pasture. Utilization measured at the end of a grazing period on both NF Pastures would be indicative of utilization determined at the end of the growing season because the growing season terminated before use estimates were made.

1984. The main cow herd was moved to the NNF Pasture about July 10. In late August and early September, the herd was moved into the SNF Pasture, where grazing continued until early October. Use on the Wet Meadow 10-16" Range Site was heavy in both pastures by the end of their respective grazing periods. Use was slight to light on all other range sites except for moderate use on the Riparian Aspen Range Site in the SNF Pasture. These rather low

levels of use on most range sites were probably due to a reduction in herd size and high forage production in 1984. Utilization levels were generally lower than in 1983 on the early-use pasture and equal or slightly higher on the late-use pastures.

The most heavily grazed species in both pastures were the wet meadow species meadow bluegrasses, rushes, and sedges. Other species used on these pastures were spike fescue, Great Basin wildrye, bluebunch wheatgrass, needlegrass, and antelope bitterbrush. In the late-use pasture, slight use was made of fall greenup on Sandberg bluegrass. Most grasses in the NNF were in prebloom or bloom phenology stages when cattle were turned in during July and either reached seed-ripe or cast seed by the end of early summer-grazing period. Utilization estimated at the end of a grazing period on both NF pastures would be the same as utilization determined at the end of the growing season because the growing season terminated before use estimates were made.

1985. Cattle grazed the SNF from June 21 through August 14. About August 15, the cows and calves were moved to the NNF pasture while the yearlings and dry cows were taken to private haymeadows. In late September and early October, the cows and calves were gathered from the NNF Pasture and moved to the private hay meadows. Use on the Wet Meadow 10-16" and Riparian Aspen Range Sites was severe in the early-use pasture (SNF) by the end of the grazing period. Salting along the stream bottom at the beginning of the grazing period concentrated cattle on these sites. After salt was moved to the ridges, cattle increased their use of other range sites. At the end of the grazing period, use was heavy on the South Slope 14-18" Range Site and moderate on the Dry Meadow, Aspen Woodland, and South Slope 12-14" Range Sites. Use was slight to light on all other range sites in this pasture. The Wet Meadow 10-16" and Dry Meadow 10-16" Range Sites were heavily grazed in the late-use pasture. Use on all other range sites was slight to light except for moderate use on the Loamy Slope 10-16" Range Site. These rather low levels of use on most range sites in this pasture were probably due to the reduction in herd size after the yearlings and dry cows were removed. Utilization levels in 1985 were generally higher or equal to levels recorded in 1984 in both the early- and late-use pastures. Since 1984 was a very good forage year due to abundant moisture and 1985 was drier and probably only an average forage year, higher levels of use on most range sites in 1985 than in 1984 was not unexpected.

The most preferred species over the grazing season on NF Pastures were the wet meadow species, meadow bluegrasses, sedges, and rushes. Rushes, spike fescue, needlegrass, and Great Basin wildrye were more heavily utilized early in the season during flowering than late when cured. Idaho fescue and bitterbrush received more use late in the season than early. Most forage species in the SNF were in prebloom or bloom phenology stages when cattle were turned in during June and either cast their seeds or cured by the end of the early summer grazing period. During the late summer on the NNF there was some green-up of Idaho fescue. Most other grasses were cured before cattle grazed this pasture. Utilization estimated at the end of the grazing period on both NF pastures would be the same utilization determined at the end of the growing season because the growing season terminated before use estimates were made.

Summary. Under the Saval Management Plan, grazing of the early use NF Pasture occurs when many of the grasses are in prebloom or bloom phenology stages. The Management Plan attempts to mitigate any negative effect of grazing when carbohydrate levels in plants are low. Negative effects are reduced because plants grazed during a critical growth stage in one year are not grazed until seedripe the following year. This practice is probably more effective on upland species that receive moderate use than on wet meadow species that receive heavy to severe use.

Cattle probably maintain a high level of nutrition while grazing the early-use pasture. However, the level of nutrition on the late-use pasture is probably much lower because most forage species mature before grazing begins. In 1982 the ranch manager, Ralph Vance, commented that cattle had "fallen off" in the late-use pasture, meaning that they had lost weight and did not appear as healthy as in the early-use pasture.

Generally over the past five years, utilization on range sites in the early-use pastures has been higher than on the same range sites in the late-use pasture. Also generally, in both the early- and late-use pastures riparian areas (meadow and aspen sites) received more use than upland areas. Loamy Slope and South Slope Range Sites generally received more use than did Claypan, Mountain Ridge, or North Slope Range Sites.

Meadow bluegrasses were usually the most preferred species on NF Pastures. Other meadow species (sedges and rushes) also received high levels of use over the past five years. Species consistently receiving little or no use on NF Pastures were Sandberg bluegrass, bottlebrush squirreltail, and mountain brome. Use on other species varied year to year. Spike fescue, an uncommon species, seemed to be very desirable at any phenology stage, even cured. Great Basin wildrye appeared to be preferred by cattle from prebloom to the end of the grazing season in some years, but not in others. Cattle use of bitterbrush appeared to start before bloom and continue through the grazing season. Work with fistulated steers showed that the highest use on bitterbrush occurred after a pasture had been grazed by the main cow herd in both the early- or late-grazing periods. When a pasture was sampled before grazing by the main herd, most use was on wet meadow species. From this, we can speculate that use on bitterbrush starts when more preferred meadow species are less available due to heavy or severe use.

OTHER DATA COLLECTED

Herbaceous Production Sampling

1981 through 1983 Objective:

To measure production of herbaceous species on important range sites on the Saval Allotment.

1981 through 1983 Accomplishments:

The various range sites, pasture locations, and sampling periods in various years for herbaceous production are shown in Table 3.9.

In the 1981 field season, eight sites were located and clipped periodically during the spring and early summer. Production data were collected by clipping and weighing herbage of individual species from 10 to 20 circular plots at each sampling site. Plot size was 10 ft^2 on upland sites and 1 ft^2 on the Wet and Dry Meadow Range Sites. Samples were air dried and reweighed to provide air-dry production/acre.

In 1982, 23 areas representing 12 important range sites on the Saval Allotment were sampled periodically for herbaceous production. Data were collected by a double-sampling method with a nested group of five circular plots. Four sets of nested groups were sampled each period. Plot sizes were the same as in 1981. Herbage weight was estimated on three plots. On two plots, herbage was clipped at ground level, bagged by species and weighed. Clipped samples were air-dried and reweighed and these were used to correct estimated weights to an air-dry basis.

Herbaceous production in 1983 followed the same methodology used in 1982.

All herbaceous production data have been reported in the Saval Annual Reports. These data are stored in the Elko project office.

SOIL MOISTURE

1981 through 1985 Objective:

To monitor soil moisture availability during the growing season on selected range sites.

1981 through 1985 Accomplishments:

In the fall of 1981, soil moisture blocks were installed at 6, 12 and 18 inches on nine of the areas used to sample herbaceous production. Blocks were read at approximately two week intervals during the 1982, 1983, 1984, and 1985 growing seasons. These data are stored in the Elko office with the herbaceous production and phenology data.

Table 3.9. Range sites, pasture locations, and sampling periods for herbaceous production on the Saval Allotment.

Range Site	Pasture*	Years (Times/Year) Sampled
Seeding	EDS	1982(2)
	WDS**	1981(4); 1982(2);1983(1)
	DC	1982(2)
Loamy 8-10"	LMC**	1981(2);1982(2);1983(1)
	MMC	1982(2);1983(2)
Claypan 10-12"	MMC**	1981(4);1982(2);1983(2)
	UMC	1982(2)
Loamy 10-12"	MMC	1982(2);1983(2)
	UMC**	1982(2)
Loamy Slope 10-16"	UMC**	1981(3);1982(2)
Dry Meadow 10-16"	MMC	1982(2);1983(3)
	UMC**	1981(4);1982(2)
	SNF	1982(1)
	NNF	1982(2)
Wet Meadow 10-16"	SNF**	1981(3);1982(2)
	NNF	1982(2)
Claypan 12-16"	SNF	1982(1)
	NNF	1982(2)
South Slope 10-14"	SNF**	1981(4);1982(1)
	NNF	1982(2)
Loamy Slope 16+	SNF**	1982(1)
	NNF	1982(2)
Aspen Woodland	SNF	1982(1)
	NNF	1982(2)
Steep N. Slope 16+	SNF	1981(3)

EDS = East Darling Seeding
WDS = West Darling Seeding
DC = Darling Control
LMC = Lower Mahala Creek
MMC = Middle Mahala Creek
UMC = Upper Mahala Creek
SNF = South National Forest
NNF = North National Forest
**Plots with soil moisture blocks

VEGETATION PHENOLOGY

1981 through 1985 Objective

To periodically record phenology stages of plant species during the growing season.

1981 through 1985 Accomplishments:

In 1981, phenology stages were recorded for species encountered during herbaceous production sampling. In 1982 through 1985, phenology was recorded when soil moisture blocks were read on herbaceous production sampling sites. All phenology observations are stored in the Elko office with soil moisture and herbaceous production data.

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PART B: A STUDY OF FACTORS INFLUENCING SECONDARY SUCCESSION

Richard E. Eckert, Jr. and Fay L. Emmerich

1985 Objectives:

1. Determine the quantity and quality of seed produced by native and introduced grasses.

2. Continue research on the influence of season of emergence, sagebrush competition, soil-surface type, and probability of simulated precipitation on emergence and establishment of native and introduced grasses.

1985 Accomplishments:

Methods-Objectives 1. Seed of native grasses was collected on six low to high elevation range sites: Loamy 8-10", Loamy 10-12", Claypan 10-12", South Slope 12-14", South Slope 14-18", and Riparian Aspen Woodland. Also, crested wheatgrass seed was collected on the Lower Sheep Creek seeding. At each location, a sample consisted of five transects with five, 21.5 $ft.^2$ plots/transects. Seed was air-dried and hand-thrashed. Seed was separated from chaff with a clipper mill. Total seed weight, test weight/100 seeds, and germination were determined. From these data, seed density/ft^2 was calculated. These characteristics determined over time will define the variability in quantity and quality of seed in relation to climate, past grazing use (phenology and degree of use), range site, and range condition.

Seed yields for the Loamy 8-10", Loamy 10-12", Claypan 10-12", and South Slope 12-14" range sites were collected at the same location as in 1983 and 1984. This was possible because seed was harvested prior to cattle grazing on inside exclosures. Yield of crested wheatgrass seed was sampled in a different seeded pasture than in 1983 or 1984. Seed samples for the South Slope 14-18" and Riparian Aspen Woodland sites were collected on the same sites as in 1983.

Methods-Objective 2. The purpose of this study was to evaluate the effects of season of emergence, brush competition, soil-surface type, and probability of simulated precipitation on emergence, survival, and establishment of seedlings of four grass species. The study was conducted on three range sites: Loamy 8-10", Loamy 10-12", and Claypan 10-12". All shrubs were removed from two sets of plots in late July 1984. Two seedings were made: early October 1984 to evaluate spring 1985 emergence, and early August 1985 to evaluate fall 1985 emergence. In each replication of each brush treatment for each time of seeding, four, 1 ft^2 plots were randomly located on coppice soil and four plots were located on interspace soil. Each plot was subdivided into four randomly selected 0.25 ft^2 subplots. Crested wheatgrass, bluebunch wheatgrass, bottlebrush squirreltail, and Thurber needlegrass were seeded in early October 1984 to obtain spring 1985 emergence and in August 1985 to obtain fall 1985 emergence. Seed was broadcast on the soil surface and mixed with the surface half inch of soil.

Four precipitation probability treatments were randomized on the soil-surface plot. These were: natural precipitation falling from May to the end of September, 1984; 50% probability - simulated precipitation equal to 50% probability of a weekly amount of precipitation from May to the end of September, 25% probability and 5% probability. The amounts of precipitation applied by these treatments for months representing spring 1985 and fall 1985 emergence studies are shown in Table 3.14. Simulated precipitation treatments were applied weekly. A measured amount of water was applied from a sprinkler can over a plot frame that minimized movement of surface water among subplots and from the inside of the plot to the outside of the plot. Experimental design within each brush treatment was a 2x4x4 factorial with six replications. Gypsum soil moisture blocks were buried at depths of 1,2, 3 and 4 inches in two of the six replications before seeding. Soil moisture data were collected immediately before watering and at intervals of 1, 2, 3, and 4 days after watering. Meter readings were converted to bars of soil moisture tension. Seedlings were counted in May, June, August, and October for the spring-emerged seedlings and in October for the fall-emerged seedlings. Seedling density data for each brush treatment were analyzed by a 3-factor analysis of variance to determine treatment effects and interaction averaged over dates, species, and soil-surface types with significant ($P \leq 0.05$) means determined by Duncan's multiple range test. A sample of fall-emerged seedlings present on all plots at the three study sites was marked with toothpicks to determine winter survival.

Results-Objective 1. Seed yields for 1985 are shown in Table 3.10 together with 1983 and 1984 yields for comparison. For samples collected from the same location each year, seed yield was highest in 1983 for Sandberg bluegrass and squirreltail on the Loamy 8-10", Loamy 10-12", and Claypan 10-12" Range Sites and for bluebunch wheatgrass on the South Slope 12-14" Range Site. For samples collected on the same range site or seedling but not from the same location each year, seed yield in general was highest in 1983 for crested wheatgrass on the seeding, and for bluebunch wheatgrass and Idaho fescue on the South Slope 14-18" Range Site. Also, seed production was highest in 1983 for mountain bromegrass, slender wheatgrass, and Kentucky bluegrass on the Riparian Aspen Woodland Range Site. Seed production was highest in 1985 for mountain bromegrass on the South Slope 14-18" Range Site. For the same comparisons, 1985 seed production was generally the lowest of the three years.

On low elevation range sites in poor range condition, seed yields of increaser species such as Sandberg bluegrass and squirreltail were always greater in each of the three years than were seed yields of decreaser species such as Thurber needlegrass and bluebunch wheatgrass. On better condition sites at higher elevations, the more desirable species produced more seed than did the less desirable species.

Germination of crested wheatgrass, Sandberg bluegrass, and squirreltail generally was high in all three years (Table 3.11). Germination of Thurber needlegrass, bluebunch wheatgrass, mountain bromegrass, slender wheatgrass, and Kentucky bluegrass fluctuated widely among years. Since most empty florets were removed from the sample in the cleaning process, differences in germination must be due to seed characteristics influenced by environmental conditions present during the process of seed development, seed dormancy, or to differences in germination requirements.

Table 3.10. Mean seed yield (lb/ac) on seeding and on six range sites in 1983, 1984, and 1985. Seeds were collected from the same kind of seedings and range sites, but not necessarily in the same sample location. The same locations sampled in all three years are indicated by an asterisk.

Range site or seeding	Species[1]														
	Agde			Posa			Sihy			Stth			Agsp		
	1983	1984	1985	1983	1984	1985	1983	1984	1985	1983	1984	1985	1983	1984	1985
Seeding	23.3	4.9	7.9	--[2]	--	--	--	--	--	--	--	--	--	--	--
*Loamy 8-10"	--	--	--	41.5	0.8	0.9	9.3	1.6	0.7	--	--	--	--	--	--
*Loamy 10-12"	--	--	--	16.5	7.6	0.1	6.8	2.7	2.0	0.3	0.2	0.1	--	--	--
*Claypan 10-12"	--	--	--	34.2	9.7	1.6	6.4	4.1	0.6	0.2	0.5	--	--	--	--
*S. Slope 12-14"	--	--	--	23.4	1.9	0.8	6.9	1.8	4.8	--	--	--	3.3	1.8	1.1
	Posa			Sihy			Agsp			Brma			Feid		
South Slope 14-18"	0.1	--	0.1	0.2	--	--	1.4	0.1	--	2.5	8.6	22.3	3.3	2.1	--
	Brma			Agtr			Popr								
Riparian Aspen woodland	3.0	4.1	1.6	8.5	10.6	3.8	1.0	5.1	0.1						

[1] See Appendix 11 for species symbols with scientific and common names.

[2] Not present in sample.

Table 3.11. Mean germination (%) of species collected on a seeding and on six range sites in 1983, 1984, and 1985. Seeds were collected from the same kind of seedings and range sites, but not necessarily in the same sample location. The same locations sampled in all three years are indicated by an asterisk.

Range site or seeding	Species[1]														
	Agde			Posa			Sihy			Stth			Agsp		
	1983	1984	1985	1983	1984	1985	1983	1984	1985	1983	1984	1985	1983	1984	1985
Seeding	60	96	96	--[2]	--	--	--	--	--	--	--	--	--	--	--
*Loamy 8-10"	--	--	--	88	87	93	94	86	93	--	--	--	--	--	--
*Loamy 10-12"	--	--	--	88	88	83	90	60	91	3	8	23	--	--	--
*Claypan 10-12"	--	--	--	90	88	89	93	75	92	19	11	78	--	--	--
*S. Slope 12-14"	--	--	--	81	87	84	50	97	100	--	--	--	44	91	53
	Posa			Sihy			Agsp			Brma					
South Slope 14-18"	56	--	--	92	--	90	84	25	84	91	8	16			
	Brma			Agtr			Popr								
Riparian Aspen woodland	94	68	84	8	65	47	39	78	86						

[1] See Appendix 11 for species symbols with scientific and common names.

[2] Not present in sample.

Test weight of seed produced in the three years also varied (Table 3.12). For range sites where seed was collected from the same location each year, seed of Sandberg bluegrass was heaviest in 1983, the year of high production. Seed of squirreltail was heaviest in 1983 and 1984, also years of highest production. Seed of Sandberg bluegrass and squirreltail tended to be heavier on higher elevation sites than on lower elevation sites. On the South Slope 14-18" and Riparian Aspen Woodland Range Sites, seed collected in 1985 tended to be heavier than seed collected at the same location in 1983. Seed collected in 1984 from the same range site and from the same kind of seeding but not the same location tended to be heavier than in the other two years. Since larger seeds tend to produce more vigorous seedlings, the opportunity for seedling establishment may be greater following a year when heavy seeds are produced, given adequate environmental conditions for emergence and establishment in subsequent years.

The probability of maintenance or increase in the density of certain species on certain range sites can be interpreted from the number of viable seeds produced each year (Table 3.13). Maintenance or increase in stand density of crested wheatgrass is highly probable because of the large number of viable seeds produced each year. On low condition native stands, the large number of viable seeds of Sandberg bluegrass and squirreltail would be adequate to maintain or increase the present stand and to outcompete the more desirable species, Thurber needlegrass, which produced very few seed. On the South Slope 12-14" Range Site, a large number of Sandberg bluegrass and squirreltail seeds were produced. However, a number of bluebunch wheatgrass seeds were also produced. The stability of the stand from which the sample was collected suggests that this number of seeds is adequate to maintain stand density of bluebunch wheatgrass. The stability of the stand of desirable species on the higher elevation and mesic range sites (South Slope 14-18" and Riparian Aspen Woodland) also suggests that the number of seeds of desirable species produced on these sites is adequate to maintain the density of these species.

Results-Objective 2. An example of spring 1985-emerged seedlings for one site and one date is shown in Table 3.15 and for two species on four dates in Tables 3.16 and 3.17. Seedling densities on all sites and all dates generally were greater on areas with sagebrush than where sagebrush had been removed. However, seedlings tended to be taller and have more culms on areas without brush. In 22 of 24 comparisons both with and without brush, seedling density of all species was significantly greater on coppice soil than on interspace soil. The two instances where crested wheatgrass and bluebunch wheatgrass had similar densities on the two soil surfaces occurred on the Loamy 10-12" Range Site. Here, differences between coppice and interspace soils are less marked than on the Loamy 8-10" or Claypan 10-12" Range Sites. In 19 of 24 comparisons, seedling density of crested wheatgrass was significantly greater than for the other three species. Also in 11 of 12 comparisons, Thurber needlegrass was always second ranked. Seedling densities of all species were always greater on the 5/7 sample date than on the 10/1 sample date. The greatest seedling mortality occurred after the 6/17 sample date, especially for crested wheatgrass and Thurber needlegrass, the species with the highest initial seedling densities on the 5/7 sample date. Simulated precipitation treatments were significant mainly for crested wheatgrass, bluebunch wheatgrass, and Thurber needlegrass on the Loamy 10-12" and Claypan 10-12" Range Site on some sample dates. In these few instances, significantly more seedlings were found on the 5 and 25% probability precipitation treatments

Table 3.12. Mean test weight of seed (gm per 100 seeds) by species collected on six range sites and a seeding in 1983, 1984, and 1985. Seeds were collected from the same kinds of seedings and range sites, but not necessarily in the same sample location. The same locations sampled in all three years are indicated by an asterisk.

Range site and seeding	Species[1]											
	1983	Agde 1984	1985	1983	Posa 1984	1985	1983	Sihy 1984	1985	1983	Stth 1984	1985
Seeding	.160	.222	.182	--[2]	--	--	--	--	--	--	--	--
*Loamy 8-10"	--	--	--	.038	.033	.035	.193	.198	.174	--	--	--
*Claypan 10-12"	--	--	--	.044	.032	.031	.199	.199	.148	.230	.264	.268
*Loamy 10-12"	--	--	--	.046	.032	.038	.132	.186	.162	.160	.288	.277
		Posa			Agsp			Sihy			Elci	
*S. Slope 12-14"	.052	.044	.037	.159	.258	.222	.177	.336	.284	.290	.253	.248
		Brca			Feid			Agsp			Heki	
South Slope 14-18"	.573	.659	.530	.078	.088	--	.243	.101	--	.161	.258	.209
		Agtr			Brma			Popr				
Riparian Aspen woodland	.345	.394	.352	.656	.807	.674	.024	.024	.033			

[1] See Appendix II for species symbols with scientific and common names.

[2] Not present in sample.

Table 3.13. Mean number of viable seeds/ft^2 in 1983, 1984, and 1985 on a seeding and on six range sites. Data on seed yield, weight/100 seeds, and % germination used to calculate seed density were collected from the same kind of seedings and range sites, but not necessarily in the same sample location. The same locations sampled in all three years are indicated by an asterisk.

Range site or seeding	Species[1]														
	Agde			Posa			Sihy			Stth			Agsp		
	1983	1984	1985	1983	1984	1985	1983	1984	1985	1983	1984	1985	1983	1984	1985
Seeding	91	22	43	--[2]	--	--	--	--	--	--	--	--	--	--	--
*Loamy 8-10"	--	--	--	999	22	25	47	7	4	--	--	--	--	--	--
*Loamy 10-12"	--	--	--	328	217	3	48	9	10	.06	.01	.1	--	--	--
*Claypan 10-12"	--	--	--	689	277	42	25	16	3	.2	.09	--	--	--	--
*South Slope 12-14"	--	--	--	397	39	18	20	5	18	--	--	--	9	7	3
	Agsp			Brma			Heki								
South Slope 14-18"	5	2	--	4	1	1	10	5	--						
	Brma			Agtr			Popr								
Riparian Aspen woodland	4	4	1	2	18	1	17	172	3						

[1]See Appendix II for species symbols with scientific and common names.

[2]Not present in sample

Table 3.14. Total of natural and simulated precipitation (in.) present on each precipitation treatment for spring 1985 and fall 1985 emerged seedlings.

Range site and precipitation treatment		Spring 1985 emerged seedlings					
Loamy 8-10"		May[1]	June	July	Aug	Sept[2]	Total
Natural, Oct-May	4.4						
Natural, by month		1.0	0.5	0.5	0.1	0.5	2.6
50% probability		1.2	0.6	0.5	0.2	0.5	3.0
25% probability		1.5	1.1	0.7	0.3	0.7	4.3
5% probability		2.7	3.0	2.4	1.6	1.6	11.3
Loamy 10-12"							
Natural, Oct-May	5.6						
Natural, by month		0.8	0.5	0.6	0.2	0.6	2.7
50% probability		1.1	0.6	0.6	0.3	0.6	3.2
25% probability		1.7	1.2	0.8	0.5	0.9	5.1
5% probability		3.7	3.9	3.2	2.1	2.2	15.1
Claypan 10-12"							
Natural, Oct-May	3.7						
Natural, by month		1.0	0.3	0.4	0.1	0.5	2.3
50% probability		1.2	0.4	0.4	0.2	0.5	2.7
25% probability		1.6	1.0	0.7	0.4	0.7	4.4
5% probability		2.9	3.5	2.7	1.8	1.9	12.8

		Fall 1985 emerged seedlings		
Loamy 8-10"		Aug[3]	Sept[4]	Total
Natural, Aug-Sept	0.6			
Natural, by month		0.1	0.5	0.6
50% probability		0.1	0.5	0.6
25% probability		0.2	0.9	1.1
5% probability		0.6	2.4	3.0
Loamy 10-12"				
Natural, Aug-Sept	0.8			
Natural, by month		0.2	0.6	0.8
50% probability		0.3	0.5	0.8
25% probability		0.4	1.2	3.0
5% probability		0.8	3.3	4.1
Claypan 10-12"				
Natural, Aug-Sept	0.8			
Natural, by month		0.2	0.6	0.8
50% probability		0.2	0.8	0.8
25% probability		0.3	1.0	1.3
5% probability		0.8	2.9	2.7

[1] From May 7

[2] Until Sept 23

[3] From Aug 20

[4] Until Oct 2

Table 3.15. Mean seedling density/0.25 ft^2 in August 1985 on a Loamy 10-12" range site in response to soil surface type, simulated precipitation (% probability), and species main effects with and without competition. Plots were seeded with 100 viable seeds in October 1984. Seedlings emerged in spring 1985.

Competition level	Main effects			
	Soil-surface type			
	Coppice	Interspace		
With brush	4.0 a[1]	2.2 b		
Without brush	2.7 a	2.1 b		
	Species			
	Crested wheatgrass	Bluebunch wheatgrass	Squirreltail	Thurber needlegrass
With brush	4.6 a	2.3 b	0.0 c	5.5 a
Without brush	3.9 a	2.5 a	0.0 b	3.5 a
	Simulated precipitation (% probability)			
	Natural	50	25	5
With brush	2.3	3.1	3.9	3.2
Without brush	1.8	2.6	2.6	2.6

[1]Means within each brush treatment of each main effect followed by the same letter are not significantly different ($P \leq 0.05$). Means without letters are not significantly different.

Table 3.16. Mean seedling density/0.25 ft^2 of bluebunch wheatgrass on a Loamy 10-12" range site in response to soil surface, date of sample, and simulated precipitation (% probability). Plots were seeded with 100 viable seeds in October 1984. Seedlings emerged in spring 1985.

Competition level	Main effects			
	Soil-surface type			
		Coppice	Interspace	
With brush		2.2 a[1]	1.0 a	
Without brush		2.1 a	2.5 a	
	Date of sampling			
	5/7	6/17	8/13	10/1
With brush	3.1 a	2.9 ab	2.3 bc	2.0 c
Without brush	3.1	3.2	2.5	2.5
	Simulated precipitation (% probability)			
	Natural	50	25	5
With brush	1.8	2.0	2.2	2.3
Without brush	1.8 b	2.4 ab	2.9 a	2.1 b

[1]Means within each brush treatment of each main effect followed by the same letter are not significantly different ($P \leq 0.05$). Means without letters are not significantly different.

Table 3.17. Mean seedling density/0.25 ft^2 of Thurber needlegrass in August 1985 on a Loamy 10-12" range site in response to soil surface type, date of sample, and simulated precipitation (% probability). Plots were seeded with 100 viable seeds in October 1984. Seedlings emerged in spring 1985.

Competition level	Main effects			
	Soil-surface type			
	Coppice	Interspace		
With brush	7.2 a[1]	3.2 b		
Without brush	4.0 a	1.7 b		
	Date of sample			
	5/7	6/17	8/13	10/1
With brush	7.8 a	7.6 b	5.5 b	5.1 b
Without brush	4.3 a	3.8 ab	3.2 ab	2.7 b
	Simulated precipitation (% probability)			
	Natural	50	25	5
With brush	3.1 b	5.5 a	6.8 a	5.5 a
Without brush	2.2 b	3.3 a	2.1 b	3.7 a

[1]Means within each brush treatment of each main effect followed by the same letter are not significantly different ($P \leq 0.05$). Means without letters are not significantly different.

than on the natural and 50% probability treatments. For all comparisons, the general trend was for taller plants with more culms on the 5 and 25% treatments than on the natural and 50% probability precipitation treatments.

Significant treatment interactions showed that the greatest final seedling densities on the 10/1 sample date were found on: 1) coppice soil seeded to crested wheatgrass and receiving the 5 and 25% probability treatments and 2) coppice soil seeded to Thurber needlegrass and receiving the 25% treatment. Second ranked was Thurber needlegrass on coppice soil receiving the 5 and 50% treatments. Third ranked was crested wheatgrass seeded on interspace soil and receiving the 5 and 25% treatment and crested wheatgrass seeded on coppice soil and receiving the 50% and natural precipitation treatments.

As in 1984, very few seedlings, mostly crested wheatgrass, emerged from the late-summer seeding. Plants were small, 1 to 2 cm high and 1-3 leaves, going into winter. Based on results from 1984 and 1985, secondary succession through the mechanism of fall emergence would be a very rare occurrence.

Soil water on each study site with spring 1985-emerged seedlings was depleted to below -15 bars tension to a depth of 18 inches by the middle of June 1985. Therefore, the only water available after the middle of June was that provided by simulated precipitation treatments. None of the precipitation treatments wet the soil to a depth of 3 or 4 inches after May 30. The natural and 50% treatments did not wet to a depth of 1 inch after the middle of June. Only the 5 and 25% treatments effectively supplied water at depths of 1 and 2 inches for seedling growth and survival after the middle of June. The general pattern of soil water accretion and depletion at 1 and 2 inches in response to the 5 and 25% precipitation treatments was as follows:

1. Soil water tensions after the middle of June were greater than -15 bars at all depths before water application each week.

2. Within an hour of water application tensions were -1 bar or less on the 5% probability treatment at 1 and 2 inches on both soil surfaces and on both brush treatments.

3. The 25% probability treatment seldom decreased water tensions to less than -5 bars at both 1 and 2 inches from the middle of June until late September.

4. On the 5% probability treatment at the 1 inch depth, water tensions remained at -1 bar or less for 24 hours after water applications. One some sample dates, water tensions were less than -3 bars for 48 hours. After 72 hours, tensions were again greater than -15 bars.

5. At the 2 inch depth on the 5% probability treatment, tensions remained below -1 bar for 24 hours, less than -5 bars for 48 hours on many sample dates, and less than -10 bars for 72 hours on several dates.

Interpretations based on soil moisture data indicate that 1) soil water was not available below 4 inches from the middle of June to the end of September, 2) soil water at 1 inch was available for seedling growth and survival for one and sometimes two days per week, and 3) soil water at 2 inches was available for seedling growth and survival for two and sometimes three days per week.

CHAPTER 5

MULE DEER STUDIES

PART 1: DIET COMPOSITION AND HABITAT SELECTION OF TAMED DEER

Donald A. Klebenow and Deborah Selby

1985 Objective:

Completion of M.S. thesis.

1985 Accomplishments:

Oral examinations were passed in December, 1985. The thesis has been approved. Material from the thesis follows:

Summer Food Habits

There were 11 sampling periods during the study years, 1982 and 1983. Each sampling period was 1 or 2 weeks long, during which 1 to 3 deer were used to obtain daily samples. Only one species, Purshia tridentata, had a 100% frequency or was a part of the diet during every sampling period. Other shrub species that ranked high were Amelanchier utahensis, Rosa woodsii (91% each), and Eriogonum umbellatum and Symphoricarpos oreophilus (82%). Seventeen shrubs provided forage. Only two, Grayia spinosa and Haplopappus maconema, were present on the Stump Creek and Gance Creek study sites but not eaten.

Overall, shrubs comprised the majority of forage items during the summer period, 76% of the total number of bites of forage consumed (Table 5-1). Forbs provided 23% and grasses 1%.

Some of the more commonly fed-upon forbs were Geranium viscosissimum, Balsamorhiza sagittata, Mertensia ciliate, Penstemon watsonii, Potentilla gracilis, and Viola nuttallii. In total there were 29 species of forbs that made up more than 1% of the diet and 84 more species, each providing less than 1% of the total diet. One hundred eighteen forbs in all provided forage and only 17 additional forbs were present on the study sites, but were not eaten.

Grasses were not important. Only one species, Elymus cinereus, provided 1% of the bites in 18% of the samples. Twenty-two more species were utilized less than 1% each. One species, Poa nevadensis was present but never used.

The Influence of Cattle Grazing on Forage Selection

Prior to grazing by cattle there was no statistical significance to the differences in foraging by deer on either the Stump or Gance Creek study sites (Table 5-2). Both deer bites and forage biomass were included in the analyses.

When cattle were grazing the Stump Creek area the number of bites of forbs in the deer diet decreased significantly, countered by a significant increase in the number of bites of shrubs. The biomass of shrubs in the diet also increased significantly where cattle grazing occurred.

Table 5-1. Frequency of plant species contributing to summer mule deer diets, Gance Cr. and Stump Cr. study locations, 1982 and 1983.

Species	% Bites	% Frequency (n=11)
Shrubs utilized >1%:	76	100
Purshia tridentata		100
Amelanchier utahensis		91
Rosa woodsii		91
Eriogonum unbellatum		82
Symphoricarpus oreophilus		82
Prunus virginianus		45
Salix sp.		45
Ribes aureum		36
Eriogonum caespitosum		9
Populus tremuloides		9
Ribes cereum		9
Shrubs utilized <1%: Artemisia arbuscula, A. tridentata, Chrysothamnus nauseosus, C. viscidiflorus, Eriogonum sphaerocephalum, Ribes divaricatum		
Shrubs not utilized: Grayia spinosa, Haplopappus maconema		
Forbs utilized >1%:	23	100
Geranium viscosissimum		55
Balsamorhiza Sagittata, Mertensia ciliata, Penstemon watsonii, Potentilla gracilis, Viola nuttallii		36 each
Collomia grandiflora, Helianthella uniflora		27 each
Castilleja flava, Hackelia micantha, Mertensia oblongifolia, Osmorhiza occidentalis, Paeonia brownii, Potentilla glandulosa, Taraxacum officinale, Wyethia amplexicaulis		18 each
Allium bisceptrum, Arabis glabra, Aster occidentalis, Castilleja sp., Descurainia pinnata, Galium sp., Hydrophyllum capitatum, Phacelia ramosissima, Polygonum bistortoides, P. douglasii, Rumex triangulivalvis, Smilacina stellata, Thlaspi arvense		9 each
Forbs utilized <1%: 84 species		
Forbs not utilized: 17 species		
Grasses utilized >1%:	1	
Elymus cinereus		18
Grasses utilized <1%: 22 species		
Grasses not utilized: Poa nevadensis		

Table 5-2. A comparison of tamed deer diets on ungrazed exclosures and grazed areas before, during and after cattle grazing, 1983.

	Before cattle grazing				During cattle grazing				After cattle grazing			
	Stump Cr.		Gance Cr.		Stump Cr.		Gance Cr.		Stump Cr.		Gance Cr.	
Forage Item	UG[1]	G[2]	UG	G	UG	G	UG	G	UG	G	UG	G
Forb bites	661	1088	912	1120	2278	1130*	3218	2039	1433	511**	2542	2422
Shrub bites	5919	5047	2306	1871	7307	10359**	3174	1978	6719	10112**	8366	5135**
Grass bites	33	35	16	63	5	6	239	44**	11	14	280	52**
Total bites	6603	6147	3235	3061	9588	11488	6646	4093*	8166	10648	11091	7742*
Forb biomass	220	337	362	200	801	338	846	590	882	218*	723	660
Shrub biomass	2184	1830	874	737	1934	3037**	935	551*	3314	4723**	3007	1936**
Grass biomass	7	13	5	17	1	0.1	65	10*	4	6	38	14*
Total biomass	2408	2167	1241	1116	2785	3374	1846	1152*	4200	4953	3777	2616*

[1]UG refers to ungrazed exclosure.
[2]G refers to unprotected area where cattle grazing could occur.
*Statistical significance <0.05
**Statistical significance <0.01

On Gance Creek there was a different result. Mule deer responded to cattle grazing by consuming fewer bites of forage. The bites of grasses and total bites were less where cattle grazed than where they could not. The shrub, grass and total biomasses of deer forage also were less where cattle grazed.

After the cattle grazing period, on Stump Creek the bites of forbs were less and the bites of shrubs more where cattle had grazed. The biomass of forbs and shrubs paralleled the data on bites. Cattle grazing seemingly resulted in the mule deer consuming fewer forbs and more shrubs than if grazing by cattle had not occurred, as in the exclosure.

On Gance Creek, during the period after grazing, the number of bites and biomass of shrubs, grasses and total forage were less where cattle had grazed. Here cattle appeared to result in the deer consuming less forage than they would if deer alone were on the area.

In summary, our deer had two reactions to grazing by cattle. They decreased the proportion of forbs in their diet and increased the amount of shrubs in one case and decreased the total amounts of forage consumed, particularly that of grasses and shrubs, in the other.

Vegetation Type Selection by Mule Deer

On the two study sites, the greatest proportion of the habitat consisted of the mountain brush vegetation type (Table 5-3). This was particularly true on the Gance Creek site. On this site the wildrye-mountain brush vegetation type was a close associate of the mountain brush type, differing mainly because of its location on a southern exposure. Great Basin wildrye dominate on these more arid sites. On the Stump Creek site there were several vegetation types dominated by big and low sagebrush in addition to the mountain brush, aspen and riparian types.

The greatest amount of use by deer on Stump Creek was in the mountain brush and riparian brush vegetation types (Table 5-3). Little variation occurred in this pattern of use during the summer. On Gance Creek mountain brush was used the most before grazing, and wildrye-mountain brush received the most use during and after grazing and was the most heavily used season-long.

Deer preferred the riparian brush type on Stump Creek. It was the only type that deer selected all through the summer grazing periods. Although it composed only 3% of the area, it was used approximately as much as the most abundant type, mountain brush.

On Gance Creek riparian brush was a preferred type, but with not as high a preference rating as on the Stump Creek site. The wildrye-mountain brush vegetation type received the same preference rating, 5.5, indicating that it was as favored a foraging location for deer as riparian brush.

The mountain brush type was rated as not preferred on both sites. Only after cattle grazing on Stump Creek did this type receive a preferred rating and then it was not highly favored.

Table 5-3. Vegetation types available on the study areas, percent deer use of these types and perferences shown by tame mule deer, 1982 and 1983.

Location and Vegetation type	Available % of Vegetation	% Deer Use				Preference Rating[1]			
		Before Grazing	During Grazing	After Grazing	Season-long	Before Grazing	During Grazing	After Grazing	Season-Long
STUMP CREEK									
Mountain brush	48	39	37	51	42	-0.2	-0.2	-0.1	-0.1
Aspen	10	6	2	1	3	-0.4	-0.8	-0.9	-0.6
Big sage	17	8	0	0	3	-0.5	-1.0	-1.0	-0.8
Low sage ridgetop	10	2	0	0	1	-0.8	-1.0	-1.0	-0.9
Low sage slope	7	8	1	0	3	0.1	0.9	-1.0	-0.6
Low & big sage mosaic	5	0	6	0	2	-1.0	0.2	-1.0	-0.6
Riparian brush	3	35	53	47	45	10.7	16.7	14.7	14.0
Riparian meadow	1	2	1	1	1	1.0	0.0	0.0	0.0
GANCE CREEK									
Mountain brush	77	32	25	20	26	-0.6	-0.7	-0.7	-0.7
Aspen	8	12	2	2	5	0.5	-0.7	-0.8	-0.4
Wildrye-mountain brush	6	20	38	59	39	2.3	5.3	8.8	5.5
Riparian brush	2	15	13	11	13	6.5	5.5	4.5	5.5
Riparian meadow	6	22	18	8	16	2.7	2.0	0.3	1.7

[1]Preference Rating = % Deer Use/% Available - 1 (-1 = no use, -0.9 to 0.0 = not preferred, and >0 = preferred)

On these two study sites the use by mule deer during the summer season did not change in a noticeable degree attributable to cattle grazing. But this research does point out the relative values of the vegetation types that were available to mule deer. The riparian brush type was most preferred, used in far greater proportion than predicted by its availability. The wildrye-mountain brush vegetation type was equally favored on Gance Creek. The other type that was of great importance of mule deer was mountain brush. While the preference rating did not indicate that it was favored, it received a great amount of deer use. It was an abundant vegetation type that deer used heavily. Overall, this type, which may include our wildrye-mountain brush designation, plus the riparian brush vegetation type, appear to be the principal vegetation types of importance to foraging mule deer.

On our study locations, the aspen vegetation type did not receive a high degree of deer use, nor was it selected out of proportion to its availability (Table 5-3). In fact, it received a negative preference rating in both instances. The low degree of use and preference rating were not expected, as this vegetation type is usually considered important for mule deer. It may not be as important for foraging as for other mule deer needs or our research may not truly reflect it's actual value.

Forage Preference

In the riparian brush type, the most preferred type on Stump Creek, two forage species were highly preferred season-long (Table 5-4). They were both shrub species, Amelanchier utahensis and Rosa woodsii, and relative to abundance, were ranked common and very common, respectively. Just four species, all shrubs, were each used for more than 5% of the bites. These four plus seven others comprised the total number of shrub species in the diet compared to 53 species of forbs. Just four species of grasses were eaten. Grasses all rated low in preference.

The other important vegetation type on the Stump Creek site was mountain brush. It was the predominant type and provided a significant amount of deer forage although it was rated as non-preferred. Amelanchier utahensis was highly preferred as forage throughout the summer period (Table 5-5). One other shrub, Rosa woodsii was highly preferred during the August-September sampling period. Two of the most abundant species in this vegetation type were Purshia tridentata and Symphoricarpus oreophilus. They each provided more than 5% of the diet but were less preferred, rating medium or low, as was the case for snowberry during June. Fourteen shrubs were in the diet plus 52 forb species and five grasses.

On Gance Creek, two vegetation types were equally preferred, the wildrye-mountain brush and the riparian brush type. Again, Amelanchier utahensis was a highly preferred shrub species throughout the summer on both of these types (Table 5-6). On the wildrye-mountain brush type, Purshia tridentata was high in preference throughout the summer, and was highly sought in June in the riparian brush type. Rosa woodsii was another shrub used on these sites. It had a medium preference rating, but together with Amelanchier and Purshia these three were forage species common to all the sites and vegetation types discussed thus far. On this study site and on these two

Table 5-4. Forage relationships of tame mule deer in the riparian brush vegetation type, the most preferred vegetation type on Stump Creek.

Forages	Abundance	Deer Preference Rating[1] June	Jul	Aug/Sep
Shrubs >5% of bites:				
Amelanchier utahensis	Common[2]	High	High	High
Purshia tridentata	Rare	Med	Med	Low
Ribes aureum	Common	Med	Med	Low
Rosa woodsii	Very Common	High	High	High
Shrubs <5% of bites:	7 species	6 Low, 1 Medium		
Forbs >5% of bites:		None		
Forbs <5% of bites:	53 species	50 low, 3 medium		
Grasses <5% of bites:	4 species	All Rated Low		

[1]Deer Preference Rating = % Deer Use/Abundance Rating (0-1 = Low, 1.1-10 = Medium, (10.1 = High)

[2]Abundance Rating: Rare - 1 (0-2% cover), Common = 2 (2.1-10% cover), Very common = 3 (10.1-35% cover), Abundant = 4 (>35.1% cover).

Table 5-5. Forage relationships of tame mule deer in the mountain brush vegetation type on Stump Creek.

Forages	Abundance	Deer Preference Rating[1] Jun	Jul	Aug/Sep
Shrubs >5% of bites:				
Amelanchier utahensis	Common[2]	High	High	High
Prunus virginiana	Rare	Low	Med	Med
Purshia tridentata	Very Common	Med	Med	Med
Rosa woodsii	Rare	Med	Med	Med
Symphoricarpus oreophilus	Very Common	Low	Med	Med
Shrubs <5% of bites:	9 species	8 Low, 1 Medium		
Forbs >5% of bites:		None		
Forbs <5% of bites:	52 species	46 Low, 2 Medium		
Grasses <5% of bites:	5 species	All Rated Low		

[1]Deer Preference Rating = % Deer Use/Abundance Rating (0-1 = Low, 1.1-10 = Medium, (10.1 = High)

[2]Abundance Rating: Rare - 1 (0-2% cover), Common = 2 (2.1-10% cover), Very common = 3 (10.1-35% cover), Abundant = 4 (>35.1% cover).

Table 5-6. Forage relationships of tame mule deer in the wildrye-mountain brush type and the riparian brush type, the two most preferred vegetation types on Gance Creek.

Vegetation Type and Forages	Abundance	Deer Preference Rating[1] Jun	Jul	Aug/Sep
WILDRYE-MOUNTAIN BRUSH				
Shrubs >5% of bites:				
Amelanchier utahensis	Common[2]	High	High	High
Eriogonum umbellatum	Rare	Med	High	Med
Purshia tridentata	Rare	High	High	High
Rosa woodsii	Rare	Med	Med	Med
Shrubs <5% of bites:	9 species	8 Low, 1 Medium		
Forbs >5% of bites:				
Balsamorhiza sagittata	Rare	None	Low	Med
Lomatium dissectum	Very Common	Med	Med	Low
Senecio integerrimus	Rare	Low	High	None
Viola nuttallii	Common	Med	Med	None
Forbs <5% of bites:	39 species	32 Low, 7 Medium		
Grasses <5% of bites:	7 species	All Rated Low		
RIPARIAN BRUSH				
Shrubs >5% of bites:				
Amelanchier utahensis	Rare	High	High	High
Prunus virginiana	Very Common	Low	Med	Low
Purshia tridentata	Rare	High	Low	Med
Rosa woodsii	Common	Med	Med	Med
Salix sp.	Very Common	Med	Med	Low
Shrubs <5% of bites:	5 species	All Rated Low		
Forbs >5% of bites:				
Aster occidentalis	Rare	None	None	High
Geranium viscosissimum	Common	Med	Low	Low
Lomatium dissectum	Rare	Med	Med	Low
Mertensia ciliata	Common	Med	High	Med
Viola nuttallii	Very Common	Low	Med	Low
Forbs <5% of bites:	45 species	35 Low, 10 Med		
Grasses <5% of bites:	5 species	4 Low, 1 Medium		

[1]Deer Preference Rating = % Deer Use/Abundance Rating (0-1 = Low, 1.1-10 = Medium, (10.1 = High)

[2]Abundance Ratings: Rare = 1 (0-2% cover), Common = 2 (2.1-10% cover), Very common = 3 (10.1-35% cover), Abundant = 4 (>35.1% cover)

vegetation types, several forb species provided more than 5% of the diet. One was highly preferred on the wildrye-mountain brush type, Senecio integerrimus, during July. In the riparian brush Aster occidentalis rated high during August and September. During July Mertensia ciliata was eagerly sought by the deer. These were the only forbs discussed thus far that received a high rating. As in the previous two types, many species of forbs were utilized by the deer. Grasses rated low in preference except for 1 species in the riparian brush rated as medium.

This mountain brush vegetation type on Gance Creek was 77% of the habitat that was available (Table 5-3). It also was important to the deer. In this vegetation type Amelanchier utahensis was again the most highly sought shrub through the summer (Table 5-7). It ranked rare in abundance. A forb, Potentilla glandulosa, and a high preference rating in June. Eleven shrubs, 44 forbs and six grasses were utilized by the deer.

Among the five vegetation types that have been discussed, some patterns occur. Amelanchier utahensis had a high preference rating on all sites during all three summer periods. It was the most highly preferred food item on the research areas. Purshia tridentata and Rosa woodsii provided over 5% of the diet on each site, although not throughout the summer months in all cases. These three shrub species were the most important species overall for foraging deer. No one species of forb was used as widely and throughout these summer periods. Rather, a wide variety of forbs were eaten. The number of species ranged from 43 to 53 on the five vegetation types discussed. Seldom was any single species of forb ranked high in preference. Furthermore, high or medium ratings for a species usually were not maintained throughout the summer season. The value of forbs appears to be not as individual species, but as an overall vegetation class. Nearly all species were used as food by the deer. Grasses all ranked low in preference, except for one medium rating.

In the preferred vegetation type, the riparian brush, the forage relationships were similar to those in the mountain brush vegetation type.

Table 5-7. Forage relationships of tamed mule deer in the mountain brush vegetation type on Gance Creek.

Forages	Abundance	Deer Preference Rating[1] June	Jul	Aug/Sep
Shrubs >5% of bites:				
Amelanchier utahensis	Rare[2]	High	High	High
Eriogonum umbellatum	Very Common	Med	Med	Med
Purshia tridentata	Common	Med	None	None
Rosa woodsii	Rare	None	Med	Med
Symphoricarpus oreophilus	Common	Med	Med	Med
Shrubs <5% of bites:	6 species	All Rated Low		
Forbs >5% of bites:				
Hydrophyllum capitatum	Rare	Med	None	None
Potentilla glandulosa	Rare	High	Med	None
Potentilla gracilis	Rare	Med	Med	None
Viola nuttallii	Very Common	Med	Med	Low
Forbs <5% of bites:	40 species	28 Low, 12 Med		
Grasses <5% of bites:	6 species	All Rated Low		

[1]Deer Preference Rating = % Deer use/Abundance Rating (0-1 = Low, 1.1-10 = Medium, (10.1 = High)

[2]Abundance Rating: Rare = 1 (0-2% cover), Common = 2 (2.1-10% cover), Very common = 3 (10.1-35% cover), Abundant = 4 (>35.1% cover)

PART 2: THE IMPACT OF CATTLE GRAZING ON MULE DEER HABITAT USE AND DISTRIBUTION

Mike Rule

1985 Objectives

1. To complete data collection on mule deer habitat using methodology described in the 1984 Progress Report.

2. Data entry into a computerized data base management system, analysis of data, and completion of M.S. Thesis.

1985 Accomplishments

Data Collections

Data collection of observational data was completed during the 1985 summer field season. A total of 572 hours of behavioral observations were made of deer habitat utilization on the Forest Service summer grazing allotment.

Some modifications of the study design were necessary due to the uncertainty of there being a grazing season due to problems with fence maintenance. Originally, observations were to be made during the early grazing period (July 1 to August 15) on two sets of paired plots. The plots on the south Forest Service pasture would represent the grazed treatment and the north pasture plots the control (not grazed during the early period). Without a grazing season, a decision was made to replicate observations on 10 sites completed in a similar 1983 study, by Dr. Donald Klebenow and Tom Morrell, a graduate student. A comparison could then be made between a period of no grazing (1985) and a period when the grazing system was working reasonably well (1983). Data collection was begun, and the investigator was informed on June 15th that cattle would be present on the Forest Service, June 20. A commitment to the new approach had been made, and a return to the original study design would mean a loss in valuable data. It was decided to continue with the new course with some further notifications to provide more detailed information on distribution and to improve the coverage of the study area. The modifications included the plotting of deer and cattle observations on a coordinate system, mapping of habitat types in the observation areas, and the addition of three study sites with exclusion of two from 1983 to improve coverage of all habitat types available in the Forest Service allotment.

Data Entry and Analysis

The investigator has taken temporary employment with the U.S. Fish and Wildlife Service making data analysis difficult. However, data entry to computerized data files is being completed on a personal computer. Data entry is 70% completed. Analysis using statistical software will be initiated in October 1986 when access to a mainframe computer is possible. The nature of the data base precludes preliminary results. It is the hope of the investigator to complete data analysis and the M.S. Thesis by June of 1987.

PART 3: THE INFLUENCE OF CATTLE GRAZING ON MULE DEER DIETS AND HABITAT IN ASPEN COMMUNITIES OF NORTHEASTERN NEVADA

Thomas E. Morrell and Donald A. Klebenow

1985 Objectives

Complete a two-year study which will evaluate the effect that cattle grazing in aspen (Populus tremuloides) communities has on mule deer (Odocoileus hemionus) diets and habitat. The objectives include: (1) evaluate the effect of cattle grazing in the aspen community on mule deer forage selection, (2) evaluate the nutritional quality of forages selected by mule deer on grazed and non-grazed aspen areas, and (3) evaluate the effect of cattle activity on potential mule deer hiding cover in the aspen community.

The decision to carry out the experiment in an aspen community was based upon observations made during the summer of 1983, which indicated that the aspen stands on the U.S. Forest Service's grazing allotments represented the one plant community that received use by mule deer and cattle throughout the grazing season.

1985 Accomplishments

The draft thesis has been completed by the graduate student. Thesis copies will be available for distribution during the summer, 1985. Parts of what follows are condensed portions of the thesis.

Study Area

The study area is located near the headwaters of Stump Creek on the north pasture of the Forest Service East Independence Grazing Allotment. The site is characteristic of young to mid-age aspen stands on the Saval Ranch.

A dense aspen canopy of 90% occurs on the study site. The lush understory consists of 8 grass and grasslike species, 56 forb species and 11 shrub species. Table 5-8 displays the percent cover of important understory species lower than 1.5 m in height.

A. Evaluating the effect of cattle grazing on mule deer forage selection and quality of selected forages.

Field Work

As in the first year (1984), the diets of two tame female mule deer were evaluated in four contiguous 3/4 acre pens during four time periods through the summer. Of the four pens, two of the pens are grazed by cattle and two were left ungrazed and used as a control. Grazing treatments involved placing three fistulated heifers in a pen allowing them to forage intermittently until a 50-70% utilization of grasses was achieved. The grazing treatments occurred during time 2, for an early grazing treatment and during time 3 for a late treatment (Fig. 5-1). During time periods 1 and 4 none of the pens were grazed by the cattle. This design allowed the deer diets to be sampled before, during, and after early and late summer grazing.

Table 5-8. Percent ground cover of important species in four pens within an aspen community prior to cattle activity in the first year.

Forage class and species	Pen 1	Pen 2	Pen 3	Pen 4
Grasses (all)	6.0	9.4	7.1	7.5
Forbs				
Agastache urticifolia	6.6	4.6	5.2	6.6
Aster occidentalis	5.7	4.4	5.0	3.4
Geranium viscosissimum	4.7a	2.9ab	2.1ab	1.6b
Hackelia micrantha	6.5	5.2	4.0	6.2
Osmorhiza occidentalis	25.3a	35.2	32.5	24.3a
Potentilla glandulosa	4.0	3.1	1.7	t
Stellaria jamesiana	7.7	7.3	6.7	9.2
Valeriana acutiloba	3.1	2.4	2.7	1.3
Viola nutallii	1.4	1.6	1.9	t
Shrubs				
Amalanchier utahensis	t	1.0	t	t
Populus tremuloides	5.9	9.8	10.0	8.5
Ribes aureum	4.1	3.1	4.0	4.2
Symphoricarpos oreophillus	16.9ab	13.3a	18.7a	23.1b

Means with same superscript are significantly different at $P<0.05$.
t = species cover <1% in the pen.

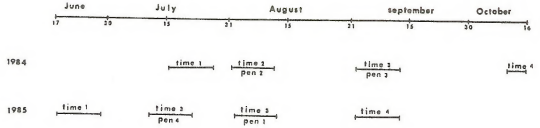


Fig. 5-1. Schedule of deer foraging periods and cattle grazing treatments in 1984 and 1985. The pen that received early (time 2) or late (time 3) grazing treatment is shown below the time period when grazing took place.

In each time period the deer diets were sampled four times in each pen. Feeding trials lasted 60 minutes per deer and took place in the early mornings and late afternoons.

The biomass of forage species selected and consumed by the deer was estimated by multiplying the mean weight of 25 to 50 air dried hand picked simulated bites by the number of bites taken of that item. Weight estimates were made for all forage species during each time period to account for changes in bite sizes by deer through the summer and between years.

Composite diets were made of the forb and shrub components of the deer diets for all pens and time periods. Forage species that contributed to two percent or more of the total bites taken by both deer in a pen during a foraging period were marked and collected immediately following the final foraging bout. Percent crude protein of the composite diets was determined using the Kjeldahl procedure. Dietary percent crude protein was weighted based on forb and shrub diet composition of the deer.

Analysis of variance was used to determine significant differences in the percent of bites taken, the amount of biomass consumed, and deer diet nutrition among treatments at each time period. Simple analysis of variance was used to compare the relative proportions of forage classes in the diets between deer within each time period. For all tests on diet and nutrition, data from the two control pens were combined. Data for each year were analyzed separately. Unless otherwise stated all significance levels reported are at the $P<0.05$ level.

Results

During 236 individual observations, two tame mule deer took a total of 112,376 bites consuming an estimated 26,661 grams of air dried forage from 75 plant species. Nineteen species accounted for 89% of the total bites and 91% of the total biomass consumed. The proportion of major forage classes in the deer diets did not differ between the deer, except during period one of the second year when one deer consumed 15% more forbs than the other in all of the pens combined.

In terms of the number of bites taken (Table 5-9 and 5-10) and the amount of biomass consumed (Figs. 5-2, 5-4), forbs made up the largest part of the deer diets in the control treatment pens through the first three Periods of 1984 and for all periods in 1985. During these periods, regardless of treatment, forbs contributed to at least 66% of the bites taken and 59% of the biomass in the deer diets. In period four of the first year, shrubs became the most important diet constituent in all pens. Grasses were insignificant in the deer diets for all pens and time periods.

Year One

In period one, prior to cattle activity, there was no significant differences in the dietary proportions of principal forage species measured as bites taken (Table 5-8) or biomass consumed (Fig. 5-2) among the treatments. However, during periods two and three the deer responded to grazing by taking a smaller proportion of bites of forbs and a higher proportion of shrubs. They also

Table 5-9.

Percent bites of important forage species in the diets of two deer on aspen summer range exposed to three grazing treatments and four time periods during 1984.

Plant Type and Species	Time Periods											
	1			2			3			4		
	July 16 - July 26			August 1 - August 11			September 1 - September 11			October 12 - October 16		
	Control $\bar{x}\pm SE$	Early Graze $\bar{x}\pm SE$	Late Graze $\bar{x}\pm SE$	Control $\bar{x}\pm SE$	Early Graze $\bar{x}\pm SE$	Late Graze $\bar{x}\pm SE$	Control $\bar{x}\pm SE$	Early Graze $\bar{x}\pm SE$	Late Graze $\bar{x}\pm SE$	Control $\bar{x}\pm SE$	Early Graze $\bar{x}\pm SE$	Late Graze $\bar{x}\pm SE$
Grass (all)	0.1±0.1	0.3±0.1	0.2±0.1	0.8±0.3	0.7±0.1	0.7±0.4	1.8±0.8	3.0±0.7	0.1±0.1	2.3±1.8	0.9±0.8	0
Forbs												
Agastache urticifolia	$0.2\pm0.1_{a}$	$0.1\pm0.0_{ab}$	$0.1\pm0.1_{a}$	$1.2\pm0.7_{ab}$	$2.7\pm1.5_{a}$	$1.7\pm0.7_{ab}$	$0.3\pm0.1_{a}$	$0.2\pm0.1_{a}$	$1.1\pm0.2_{ab}$	$1.5\pm0.2_{ab}$	$2.9\pm0.2_{b}$	$2.6\pm1.0_{b}$
Allium bisceptrum	5.4±7.8$_{b}$	1.3±0.0	$6.0\pm0.0_{a}$	0.8±0.4	0.1±0.0	0	0	0	0	0	0	0
Aster occidentalis	$4.0\pm1.4_{ab}$	$6.9\pm4.4_{ab}$	$6.3\pm0.7_{ab}$	$9.6\pm2.8_{b}$	$2.8\pm0.2_{ab}$	20.5±0.4	$6.9\pm3.9_{ab}$	$7.0\pm0.1_{ab}$	$2.3\pm1.6_{ab}$	$1.4\pm0.8_{a}$	$5.0\pm3.9_{ab}$	$0.1\pm0.1_{a}$
Castilleja miniata	$6.9\pm3.1_{b}$	$5.3\pm5.0_{ab}$	$2.7\pm1.4_{ab}$	$4.0\pm1.3_{ab}$	$3.7\pm2.3_{ab}$	$0.5\pm0.1_{ab}$	$2.8\pm0.8_{ab}$	$0.6\pm0.3_{a}b$	$0.6\pm0.3_{ab}$	$1.0\pm0.5_{ab}$	0_{a}	0_{a}
Collomia linearis	$0.8\pm0.2_{ab}$	$0.7\pm0.4_{ab}$	$1.7\pm1.2_{b}$	$1.5\pm0.7_{b}$	$0.5\pm0.2_{ab}$	$1.7\pm0.4_{b}$	$1.3\pm0.3_{ab}$	$1.7\pm0.3_{ab}$	$0.1\pm0.1_{ab}$	0_{a}	0_{ab}	0_{ab}
Eriogonum umbellatum	1.9±1.5	0	2.4±0.3	1.8±1.1	0	1.6±0.1	1.7±0.9	0	0.3±0.3	1.1±0.6	0	0
Geranium viscosissimum	$13.3\pm5.5_{b}$	$9.7\pm7.8_{ab}$	$9.7\pm3.9_{ab}$	$9.9\pm2.1_{ab}$	$3.3\pm1.0_{ab}$	$6.9\pm0.1_{ab}$	$8.2\pm2.6_{ab}$	$4.6\pm0.5_{ab}$	$2.3\pm0.0_{ab}$	$0.5\pm0.3_{a}$	$0.1\pm0.1_{a}$	$0.6\pm0.6_{a}$
Hackelia micrantha	$10.0\pm2.6_{bc}$	$9.3\pm2.1_{bc}$	$10.8\pm2.5_{c}$	$8.4\pm2.1_{bc}$	$4.0\pm1.2_{abc}$	$5.5\pm0.4_{abc}$	$6.6\pm0.6_{bc}$	$3.6\pm1.8_{ab}$	$10.3\pm1.7_{bc}$	$0.1\pm0.0_{a}$	0_{a}	$0.6\pm0.3_{a}$
Perideridia bolanderi	$1.9\pm1.0_{ab}$	$14.8\pm6.9_{c}$	$3.0\pm0.8_{ab}$	$0.3\pm0.2_{ab}$	$13.8\pm2.8_{c}$	$6.3\pm4.2_{b}$	0_{a}	0_{ab}	0_{ab}	0_{ab}	0_{ab}	0_{ab}
Potentilla glandulosa	7.8±6.0	10.2±7.3	6.3±3.4	7.6±4.4	5.7±2.4	2.0±0.5	4.9±2.7	4.6±1.3	1.6±0.4	1.8±1.1	0.6±0.2	0
Polygonum douglasii	$1.1\pm0.8_{a}$	$1.8\pm1.5_{a}$	$0.8\pm0.4_{a}$	$12.8\pm5.4_{ab}$	$11.2\pm5.4_{ab}$	$12.5\pm3.5_{ab}$	$26.9\pm8.9_{b}$	4.3 ± 7.4	$4.3\pm1.0_{a}$	0_{a}	$0.7\pm0.7_{a}$	$0.8\pm0.8_{a}$
Stellaria jamesiana	$4.2\pm1.9_{bc}$	$2.0\pm0.9_{ab}$	$4.6\pm0.8_{bc}$	$3.7\pm0.8_{bc}$	$1.7\pm0.3_{ab}$	$6.9\pm1.3_{c}$	$0.3\pm0.0_{a}$	$0.1\pm0.0_{a}$	$0.1\pm0.1_{a}$	0_{a}	0_{a}	0
Valeriana acutiloba	$10.7\pm5.8_{b}$	$7.8\pm0.6_{ab}$	$7.9\pm0.5_{ab}$	$8.0\pm3.6_{ab}$	$6.5\pm0.4_{ab}$	$6.2\pm1.9_{ab}$	$0.2\pm0.1_{a}$	$0.6\pm0.3_{a}$	$0.2\pm0.1_{a}$	0_{a}	0_{a}	0_{a}
Viola nuttallii	$3.1\pm1.3_{bc}$	$1.5\pm0.1_{abc}$	$4.2\pm0.9_{c}$	$1.5\pm0.5_{abc}$	$0.1\pm0.0_{a}$	$2.1\pm1.2_{abc}$	0_{a}	0_{a}	0_{a}	$1.0\pm0.7_{ab}$	0_{a}	0_{a}
Wyethea amplexicaulis	4.1±2.6	0	4.2±0.6	5.1±3.0	0	2.7±2.3	0.8±0.5	0	0	0.7±0.4	0	0
Other	7.9	8.2	4.3	6.8	6.2	2.0	7.1	3.5	6.8	4.5	2.8	6.8
Total Forbs	$83.4\pm1.2_{a}$	$79.9\pm9.6_{ab}$	$75.2\pm0.3_{ab}$	$83.8\pm5.5_{a}$	$63.0\pm4.9_{b}$	$80.0\pm0.7_{ab}$	$69.8\pm10.4_{b}$	$72.5\pm5.0_{ab}$	30.1±4.3	$15.9\pm1.0_{c}$	$13.0\pm3.0_{c}$	$11.5\pm3.7_{c}$

Table 5-9. Continued.

Shrubs												
Amelanchier utahensis	4.0±1.5$_{ab}$	5.3±4.7$_{ab}$	3.3±0.3$_{ab}$	4.6±0.9$_{ab}$	3.2±1.1$_{ab}$	2.4±0.9$_{a}$	9.7±3.3$_{b}$	1.0±0.6$_{a}$	2.4±0.1$_{a}$	1.3±0.7	1.1±1.7$_{a}$	1.2±1.2$_{a}$
Populus tremuloides (dry)	1.5±0.4$_{a}$	3.3±0.7$_{a}$	7.4±0.3$_{ab}$	3.6±1.1$_{a}$	4.7±0.7$_{a}$	5.8±1.9$_{a}$	4.9±0.7$_{a}$	7.2±1.2$_{ab}$	15.6±0.9$_{bc}$	15.2±3.6$_{bc}$	19.6±8.9$_{c}$	30.9±3.7
Populus tremuloides (green)	0.1±0.1$_{a}$	0.6±0.5$_{a}$	0.1±0.1$_{a}$	1.5±0.5$_{ab}$	1.6±0.2$_{ab}$	1.4±0.3$_{ab}$	1.8±0.6$_{ab}$	3.1±0.5$_{abc}$	5.0±0.7$_{bc}$	4.8±1.9$_{bc}$	5.9±1.0$_{c}$	6.6±2.1$_{c}$
Ribes aureum	4.0±0.6$_{ab}$	5.4±3.0$_{ab}$	3.7±2.3$_{ab}$	0.6±0.2$_{a}$	1.9±0.8$_{a}$	0.8±0.4$_{a}$	1.9±1.2$_{a}$	1.6±1.6$_{a}$	5.5±4.2$_{ab}$	15.6±5.9$_{ab}$	26.0±25.9$_{b}$	26.4±2.5$_{b}$
Symphoricarpos oreophilus	5.9±1.0$_{ab}$	4.8±0.1$_{ab}$	8.9±0.1$_{ab}$	3.9±0.8$_{a}$	23.7±0.3$_{bd}$	8.7±0.8$_{ab}$	9.4±1.0$_{ab}$	10.2±0.8$_{abd}$	39.2±7.1$_{c}$	40.0±7.8$_{c}$	28.9±16.9$_{cd}$	18.7±2.0$_{bd}$
Other	0.7	0.1	0.5	0.7	0.8	0.0	0.4	1.2		2.6	2.6	0.2
Total Shrubs	16.2±1.4$_{a}$	19.5±9.2$_{ab}$	23.9±0.7$_{ab}$	14.9±5.3$_{a}$	35.9±4.6$_{b}$	19.1±0.1$_{ab}$	28.1±0.8$_{ab}$	24.3±5.7$_{ab}$	68.7±4.7$_{c}$	79.5±0.6$_{c}$	84.3±3.4$_{c}$	84.2±4.5$_{c}$
Non Vascular	0.1±0.0$_{a}$	0.1±0.1$_{a}$	0.4±0.4$_{a}$	0.3±0.3$_{a}$	0.2±0.2$_{a}$	0.2±0.2$_{a}$	0.1±0.1$_{a}$	0±0$_{a}$	0.9±0.2$_{ab}$	2.1±1.0$_{b}$	1.5±0.6$_{ab}$	4.1±0.3$_{b}$

a,b,c: Averages in a row with same superscript not significantly different at P<0.05; Row means without superscripts not different (P<0.05).

Table 5-10.

Percent bites of important forage species in the diets of two deer on aspen summer range exposed to three grazing treatments and four time periods during 1985.

Plant Type and Species	Time Periods											
	1			2			3			4		
	June 17 - June 27			July 10 - July 20			August 1 - August 11			September 1 - September 11		
	Control X̄±SE	Early Graze X̄±SE	Late Graze X̄±SE	Control X̄±SE	Early Graze X̄±SE	Late Graze X̄±SE	Control X̄±SE	Early Graze X̄±SE	Late Graze X̄±SE	Control X̄±SE	Early Graze X̄±SE	Late Graze X̄±SE
Grass (all)	$0.7\pm0.3_{ab}$	$1.7\pm1.3_{ab}$	4.3 ± 0.5	$0.1\pm0.0_{ab}$	$0.1\pm0.0_{ab}$	$1.1\pm0.9_{ab}$	$0.3\pm0.1_{ab}$	$0.1\pm0.0_{ab}$	$0.3\pm0.1_{ab}$	$0.8\pm0.8_{ab}$	$0\pm0.0_{a}$	$2.0\pm1.2_{b}$
Forbs												
Agastache urticifolia	$0.1\pm0.1_{a}$	0_{a}	0_{a}	$0.9\pm0.3_{ab}$	$2.5\pm0.9_{c}$	$0.3\pm0.1_{ab}$	$1.4\pm0.4_{b}$	$2.5\pm0.1_{c}$	$0.8\pm0.1_{ab}$	$0.8\pm0.2_{ab}$	$0.7\pm0.1_{ab}$	$1.0\pm0.2_{ab}$
Allium bisceptrum	2.0 ± 1.1	$6.9\pm2.8_{a}$	0.9 ± 0.3	0.3 ± 0.2	0.4 ± 0.1	0.3 ± 0.2	0	0.1 ± 0.1	0	0	0	0
Aster occidentalis	$26.9\pm4.0_{bc}$	$18.2\pm2.6_{ab}$	$15.9\pm7.6_{ab}$	$28.2\pm4.6_{bc}$	$2.3\pm4.6_{bc}$	$15.0\pm7.5_{ab}$	$34.7\pm7.8_{c}$	$1.3\pm0.1_{a}$	$1.2\pm0.1_{a}$	$24.5\pm4.1_{bc}$	$0.8\pm0.1_{a}$	$0.8\pm0.6_{a}$
Castilleja miniata	$1.2\pm0.3_{ab}$	$1.2\pm0.2_{ab}$	$1.2\pm1.0_{ab}$	$2.5\pm0.3_{ab}$	0_{a}	$3.8\pm3.7_{ab}$	$4.1\pm1.0_{b}$	$1.1\pm0.4_{ab}$	0_{a}	$2.1\pm0.6_{ab}$	$3.1\pm0.1_{ab}$	0_{a}
Collomia linearis	$1.6\pm0.8_{ab}$	$10.0\pm0.7_{d}$	$1.2\pm0.6_{ab}$	$3.1\pm0.8_{bc}$	$2.1\pm0.8_{abc}$	$4.1\pm0.5_{c}$	$0.2\pm0.0_{a}$	$0.1\pm0.0_{a}$	$0.1\pm0.1_{a}$	$0.4\pm0.3_{a}$	$0.1\pm0.8_{a}$	$0.2\pm0.2_{a}$
Eriogonum umbelletum	0.1 ± 0.1	$4.6\pm1.0_{a}$	0 ± 0.0	0.3 ± 0.1	$1.8\pm0.2_{b}$	0.1 ± 0.0	0.1 ± 0.0	0.5 ± 0.2	0	0.1 ± 0.1	0.5 ± 0.2	0
Geranium viscosissimum	$3.9\pm1.2_{a}$	$5.5\pm0.7_{ab}$	$7.7\pm5.3_{ab}$	$6.2\pm0.5_{ab}$	$19.5\pm1.6_{d}$	$0.1\pm4.3_{ab}$	$4.6\pm0.8_{a}$	$11.5\pm3.4_{bc}$	$17.6\pm0.8_{cd}$	$3.0\pm1.1_{a}$	$5.6\pm0.8_{ab}$	$8.3\pm0.5_{ab}$
Hackelia micrantha	$8.1\pm1.4_{abc}$	$11.3\pm0.2_{bcd}$	$11.6\pm4.4_{bcd}$	$4.5\pm0.8_{a}$	$13.7\pm6.1_{cd}$	$4.6\pm0.6_{ab}$	$6.0\pm1.5_{ab}$	$13.8\pm3.5_{cd}$	$15.1\pm2.0_{d}$	$6.1\pm0.9_{ab}$	$13.4\pm0.3_{cd}$	$13.2\pm0.9_{cd}$
Perideridia bolanderi	$18.3\pm7.4_{a}$	5.2 ± 0.1	0.2 ± 0.0	1.9 ± 1.0	0	0.3 ± 0.0	0	0	0	0.1 ± 0.1	0	0
Potentilla glandulosa	$7.5\pm2.9_{abc}$	$1.2\pm1.2_{ab}$	$16.7\pm10.3_{cd}$	$10.8\pm1.5_{abc}$	$0.2\pm0.0_{a}$	$23.0\pm6.8_{de}$	$13.0\pm2.9_{bcd}$	$0.1\pm0.1_{a}$	$30.7\pm1.5_{e}$	$12.5\pm3.6_{bcd}$	$0.1\pm0.1_{a}$	$33.8\pm2.7_{e}$
Polygonum douglasii	$1.5\pm0.8_{a}$	$8.3\pm4.4_{abc}$	$4.5\pm4.0_{ab}$	$15.6\pm3.9_{c}$	$4.0\pm1.6_{ab}$	$6.5\pm0.6_{ab}$	$10.5\pm3.3_{bc}$	$5.7\pm0.5_{ab}$	$0.5\pm0.1_{a}$	$2.1\pm1.3_{a}$	$0.6\pm0.2_{a}$	$0.4\pm0.2_{a}$
Stellaria jamesiana	$2.1\pm0.6_{bc}$	$2.9\pm0.2_{cd}$	$1.0\pm0.1_{ab}$	$3.2\pm0.4_{cd}$	$1.5\pm0.7_{abc}$	$1.4\pm0.3_{abc}$	$0.4\pm0.1_{a}$	0_{a}	$0.1\pm0.1_{a}$	$0.1\pm0.0_{a}$	0_{a}	0_{a}
Valeriana acutiloba	$5.0\pm1.3_{cd}$	$0.4\pm0.2_{a}$	$6.1\pm1.1_{d}$	$2.9\pm0.3_{bc}$	0_{a}	$5.1\pm1.8_{cd}$	$1.0\pm0.1_{ab}$	0_{a}	$0.1\pm0.1_{a}$	0_{a}	0_{a}	0_{a}
Viola nuttallii	$2.7\pm0.5_{c}$	$4.1\pm1.2_{d}$	$1.8\pm0.5_{bc}$	$0.6\pm0.1_{ab}$	$0.1\pm0.1_{a}$	$0.6\pm0.3_{ab}$	0_{a}	0_{a}	0_{a}	0_{a}	0_{a}	0_{a}
Wyethea amplexicaulis	$0.1\pm0.0_{a}$	$1.4\pm0.7_{b}$	0_{a}	$0.1\pm0.1_{a}$	$8.1\pm1.0_{c}$	0_{a}	$0.2\pm0.1_{a}$	$5.5\pm0.5_{d}$	0_{a}	$0.1\pm0.1_{a}$	$3.1\pm0.1_{e}$	0_{a}
Other	7.6	3.5	12.1	4.9	3.1	11.4	6.2	8.1	3.3	14.2	11.2	6.3
Total Forbs	$89.6\pm6.6_{d}$	$86.4\pm10.5_{cd}$	$85.2\pm5.6_{cd}$	$86.1\pm5.7_{cd}$	$59.4\pm15.6_{b}$	$87.6\pm3.7_{cd}$	$82.7\pm2.4_{cd}$	$50.4\pm5.0_{ab}$	$69.8\pm0.2_{bc}$	$66.9\pm6.5_{bc}$	$39.2\pm4.7_{a}$	$66.0\pm9.7_{bc}$

Table 5-10. Continued.

Shrubs												
Amelanchier utahensis	0.7±0.3$_{a}$	1.0±0.0$_{ab}$	2.3±0.3$_{ab}$	1.9±0.2$_{ab}$	16.4±10.4$_{d}$	3.6±0.6$_{ab}$	2.6±0.8$_{ab}$	13.8±1.8$_{cd}$	3.9±1.8$_{ab}$	8.5±1.5$_{bc}$	13.5±0.8$_{cd}$	2.6±1.9$_{ab}$
Populus tremuloides (dry)	4.4±2.2$_{abc}$	3.6±2.4$_{abc}$	3.2±2.8$_{abc}$	4.1±0.4$_{abc}$	9.6±1.4$_{c}$	2.9±0.5$_{ab}$	2.5±0.6$_{a}$	9.3±3.3$_{bc}$	6.7±1.0$_{abc}$	3.8±1.2$_{abc}$	9.0±1.9$_{bc}$	4.2±0.1$_{abc}$
Populus tremuloides (green)	1.9±0.4$_{a}$	0.7±0.2$_{a}$	1.2±0.1$_{a}$	2.2±0.3$_{a}$	3.4±1.4$_{ab}$	2.1±0.5$_{a}$	3.2±0.4$_{a}$	4.9±1.5$_{ab}$	7.0±0.3$_{bc}$	6.9±1.1$_{bc}$	13.4±2.1$_{d}$	9.9±3.5$_{d}$
Ribes aureum	0.1±0.0$_{ab}$	0$_{a}$	0.4±0.4$_{abc}$	0$_{a}$	0.4±0.2$_{ab}$	0.1±0.1$_{ab}$	0.7±0.5$_{abc}$	0$_{a}$	1.7±0.0$_{c}$	0$_{a}$	0$_{a}$	1.2±0.1$_{bc}$
Symphoricarpos oreophilus	1.7±0.4$_{a}$	5.9±5.4$_{ab}$	3.1±1.8$_{a}$	3.5±1.0$_{a}$	7.8±2.0$_{ab}$	1.3±0.5$_{a}$	6.1±1.2$_{ab}$	20.5±5.2$_{c}$	9.6±2.8$_{ab}$	11.3±2.5$_{bc}$	21.3±4.6$_{d}$	10.1±2.9$_{d}$
Other	0.3	0.2	10.2	1.7	2.6	1.0	1.4	0.3	0.5	1.3	1.8	2.1
Total Shrubs	9.1±6.0$_{a}$	11.4±9.1$_{ab}$	10.2±4.9$_{ab}$	13.4±5.6$_{ab}$	40.2±15.5$_{cd}$	11.0±2.8$_{ab}$	16.5±2.4$_{ab}$	48.8±4.5$_{cd}$	29.4±0.4$_{bc}$	31.8±5.6$_{c}$	59.0±5.2$_{d}$	30.1±8.9$_{bc}$
Non Vascular	0.4±0.2	0.2±0.0	0.2±0.1	0.1±0.1	0.2±0.0	0.2±0.0	0.2±0.1	0.7±0.4	0.2±0.0	0.5±0.1	1.8±0.5$_{a}$	1.6±0.4$_{a}$

a,b,c,d,e: Averages in a row with same superscript not significantly different at P<0.05; Row means without superscript not different (P<0.05).

consumed less biomass in the early and late pens when the pens were being grazed than in the ungrazed pens. When a significantly lower amount of forb biomass was consumed in the early and late pens during grazing, the amount of shrub biomass consumed by deer did not differ among the treatments. The sharp reduction in forb use by deer in the grazed pens resulted in diets comprised of significantly less total biomass in the early pen and less, (not significantly) total biomass in the late pen compared to the control pen diets (Fig. 5-2).

Following the removal of cattle from the early grazed pen forbs regained their importance in the deer diets during period three. The amount of forb and shrub biomass in the deer diets increased 60% and 54% in the early pen after the cattle were removed (Fig. 5-2). Despite these increases the deer consumed more biomass in the control pens than in the early grazed pen. This post grazing response in the early pen continued into period four where slightly more biomass was taken in the early grazed pen than in the control. This is in contrast to deer diet responses following late season grazing. Here the deer diets continued to decline in the amounts of forb and shrub biomass consumed after the cattle were removed.

Despite incomplete nutritional data for the first year, some apparent effects of cattle activity on deer diet quality were observed. While no differences were found in the crude protein levels of the deer diets among the treatments prior to cattle grazing, significantly lower crude protein levels were found in the deer diets during early and late grazing (Fig. 5-3). However, in period three the highest dietary crude protein levels were found in the early pen, where it had increased 53% in the diets from the level it was during grazing.

Year Two

With a few notable exceptions the deer diets during the second year displayed similar responses to cattle grazing as observed in the previous year. Again no differences were found in the proportions of bites taken and the amount of biomass consumed among treatment pens during period one (Table 5-9, Fig. 5-4). In period two the deer took a significantly lower proportion ($P< 0.05$) of bites from forbs and consumed less ($P<0.10$) forb biomass in the early grazed pen than in the ungrazed pens. The amount of shrub biomass consumed in the early pen was slightly higher but did not differ significantly from the ungrazed pens. Although not significant, the amounts of total biomass consumed in the early pen was 26% and 18% less than the amounts consumed in the ungrazed control and late pens, respectively (Fig. 5-4).

Similarly, the deer took significantly less (45%) total biomass in the late pen when it was grazed than in the control pens during Period Three. Again the differences resulted from dramatic shifts in forb use by the deer. Where the amount of shrub biomass in the control and late pens did not differ, forb biomass consumption was 54% less in the grazed pen than in the control pens (Fig. 5-4).

Following early and late season grazing, the deer diets showed only slight increases in biomass consumption in pens which had previously been grazed.

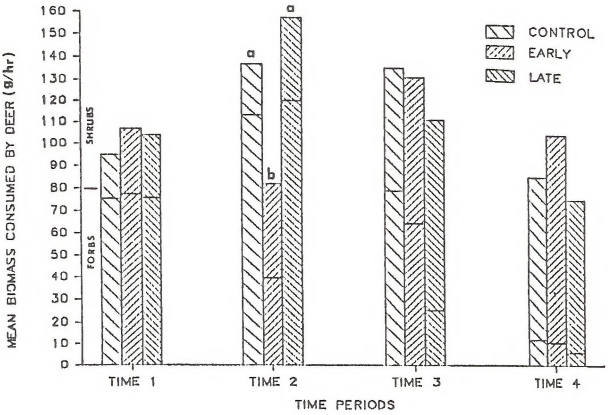


Fig. 5-2. Mean air-dried biomass consumed by deer exposed to three grazing treatments in 1984. Early grazing took place at time two and late grazing at time three. Different letters above each bar indicate significant ($P < 0.05$) differences between treatments within time periods.

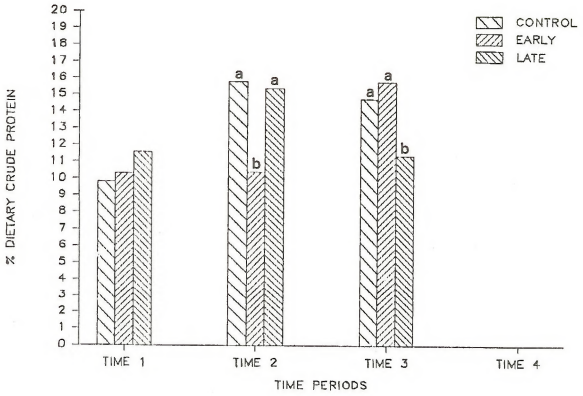


Fig. 5-3. Weighted % crude protein in deer diets exposed to three grazing treatments in 1984. Early grazing took place at time two and late grazing at time three. Different letters above each bar indicate significant ($P<0.05$) differences between treatments within time periods.

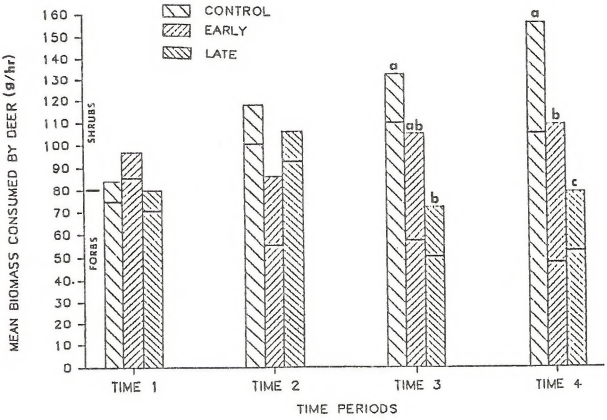


Fig. 5-4. Mean air-dried biomass consumed by deer exposed to three grazing treatments in 1985. Early grazing took place at time two and late grazing at time three. Different letters above each bar indicate significant ($P<0.05$) differences between treatments within time periods.

In period four significant differences in biomass were found among all treatments. More biomass was consumed in the control pens than either of the grazed pens during this period. However, the percent of bites taken of each of the forage classes did not differ between the control and late grazed pens.

The weighted crude protein levels in the deer diets did not differ among treatments in periods one or two (Fig. 5-5). This is in contrast to the first year where significantly less percent dietary crude protein was found in the early grazed pen during period two. Crude protein in the deer diets was significantly less in the late grazed pen than in the ungrazed pens in period three. Again, deer diets in the early pen and slightly higher crude protein levels following grazing than diets in the control pen. Differences in dietary crude protein between the late grazed pen and the control pens continued in period four where the highest crude protein levels were recorded in the control pens. Crude protein between the control and early pens did not differ in period four.

Conclusion

Mule deer diets and nutrition showed consistent but variable responces to early and late summer grazing by cattle in an aspen community. The three criteria used to compare deer diets on grazed and ungrazed areas, proportion of bites taken of forage classes, biomass consumed, and percent of dietary crude protein, showed similar results. In general, the deer took proportionally fewer bites of forbs and more of shrubs, consumed less total biomass, and had lower levels of crude protein in their diets when foraging in pens being grazed by cattle.

B. Evaluation of the effects of cattle on potential mule deer hiding cover.

Methods

Differences in horizontal cover between grazed and ungrazed pens were evaluated using a vegetation profile board (Nudds 1977). The horizontal cover was estimated for each of five 30 cm intervals from ground level to 1.5 m with a 25 cm wide by 1.5 m high board. The proportion of each 30 cm interval obscured by vegetation from a distance of 15 m was recorded as a single digit "cover score" which corresponded to the mean value of a range of quintiles (Nudds 1977).

Horizontal cover was measured in each of four contiguous 0.3 ha pens during three time periods through the summer of 1984; July 17-21 (1), August 12-16 (2), and September 12-16 (3) and during four time periods in 1985; June 17-21 (1), July 21-24 (2), August 12-16 (3), and September 6-10 (4). For each year a cattle grazing treatment was applied to one of the four pens prior to the second sample period and to a different pen prior to the third sample period.

For each period cover readings were taken from 40 permanently established points in each pen. Four points were randomly located along 10 randomly placed 30 m transects in a pen. The cardinal direction from which a reading was taken was also randomly selected.

Simple analysis of variance was used to test for differences in mean horizontal cover among treatments during each sample period.

Results

Analysis of these data revealed that the only differences in cover between grazed and ungrazed pens occurred at the two lowest height class levels during periods two and three. Immediately after grazing horizontal cover at height classes one and two in the early grazed pen were significantly lower than in the ungrazed late and control pens. The cover differences between the early grazed pen and the control pens persisted during period three. Similarly, immediately following grazing in the late grazed pen the horizontal cover at level one was significantly less than in the control pen. Horizontal cover among treatments did not differ at any level in period 4.

Conclusion

The important finding of this study was the significant reduction in horizontal cover at the two lowest height class levels monitored (0 to 30 cm and 31 to 60 cm) with early and late summer season cattle grazing. The literature suggests the changes in horizontal cover at these levels may negatively influence mule deer survival.

Publication Schedule

We plan to submit publications to the Journal of Wildlife Management (Deer diets and nutrition) and to the Wildlife Society Bulletin (Horizontal cover) by September, 1985.

Literature Cited

Nudds, T.D. 1977. Quantifying the vegetative structure of wildlife cover. Wildl. Soc. Bull. 5(3):113-117

CHAPTER 6

NONGAME WILDLIFE RESEARCH

Gary N. Back, Donald A. Klebenow, and J. Kent McAdoo

PART 1: EFFECTS OF BRUSH CONTROL AND SEEDING ON RODENTS

1985 Objective:

Collect one more year of data. After reviewing the analysis of four years of rodent trapping data, we decided that a fifth year of data was required to fully explain the population responses.

1985 Accomplishments:

The field work was completed: Data were prepared for computer card format (required for analysis by the program "Capture"). A manuscript for the Journal of Range Management will be submitted in late 1986 or 1987.

PART 2: MOUNTAIN VOLE POPULATION CYCLE

1985 Objective:

To collect additional population data, finish data analysis, and prepare a manuscript.

1985 Accomplishments:

Date collection was completed. Data analysis and manuscript preparation were rescheduled for 1986 due to personnel changes and prioritization of the workload.

PART 3: HABITAT AFFINITIES OF MERRIAM'S SHREW

1985 Objective:

Submit a manuscript to Southwestern Naturalist.

1985 Accomplishment:

A manuscript entitled, "Habitat Affinities of Sorex merriami in Northern Nevada", and co-authored by Mark A. Ports and J. Kent McAdoo was submitted to Southwestern Naturalist. It has been accepted for publication and is currently "in press".

The following is an abstract of this publication:

Prior to our work, only one Merriam's shrew had been collected in northeastern Nevada. Even for the Great Basin region in general, little information on shrews is available. In basin areas (valley floors) we caught shrews in habitats with moderate shrub cover of big sagebrush, rubber rabbitbrush, and antelope bitterbrush. Typical understory consisted of sparse forbs, bunchgrasses, and usually extensive bare ground. In these areas, shrews were caught 10 to 200 m away from creek beds in relatively dry soils. We also caught Merriam's shrews at higher elevations on south-facing slopes. The dense shrub cover here consisted of big sagebrush, antelope bitterbrush, squaw currant, and mountain snowberry with almost no understory. These habitats were situated on dry, well-drained soils several hundred meters from the nearest drainage. Our records indicate that Merriam's shrew, although inconspicuous, is a fairly common member of small mammal communities in sagebrush basins and in mountain brush habitats of northeastern Nevada.

PART 4: MICROHABITAT CHARACTERISTICS AND OVERLAP OF THREE SYMPATRIC SHREW SPECIES

1985 Objective:

To prepare and submit a manuscript to the Journal of Mammalogy.

1985 Accomplishment:

A manuscript was submitted to the Journal of Mammalogy. It is entitled, "Microhabitat Characteristics and Overlap in Three Species of Long-tailed Shrews (Genus Sorex) from the Great Basin". The co-authors are Mark A. Ports and J. Kent McAdoo.

The abstract of this manuscript follows below:

Previous nongame inventory work revealed the presence of several shrew species in the Saval study area, and further sampling showed sympatric occurrence of species along ephemeral drainages. Percent total canopy cover was significantly ($P<0.05$) different among the sites where the three species were collect. Montane shrews were found in areas of highest total cover, while Merriam's shrews were found in sites with least total cover. Montane and vagrant shrews frequented areas with similar percent herbaceous cover, but Merriam's shrews were found where herbaceous cover was significantly less ($P<0.05$). Montane shrews were found in areas with significantly higher percent shrub cover, while the other two species occupied areas similar in shrub cover. Our data imply some microhabitat partitioning among the three sympatric shrew species. The data also represent the first recorded instance of montane shrews in a big sagebrush-rubber rabbitbrush habitat in association with Merriam's shrews.

PART 5: BLACK-TAILED JACKRABBIT USE OF NEW RANGELAND SEEDINGS

1985 Objective:

To revise the manuscript and submit it to Journal of Range Management.

1985 Accomplishment:

The manuscript was revised and submitted to Journal of Range Management. This manuscript includes data from both the University of Nevada Gund Research and Demonstration Ranch and the Saval Ranch Project. The title is, "Use of New Rangeland Seedings by Black-Tailed Jackrabbits", by J. Kent McAdoo, William S. Longland, Greg J. Cluff, and Donald A. Klebenow. The abstract follows: Black-tailed jackrabbit (Lepus californicus) use of three new rangeland seedings in northern and central Nevada was determined by pellet counts for the first growing seasons following seeding establishment. Jackrabbit use was an inverse function of seeding size (as indicated by distance from the seeding edges to midpoints) and of distance at which use was measured into the seeding. Use was uniformly high for a small (50 ha) seeding from its edge to its midpoint. A larger (400 ha) seeding received significantly higher use at the edge than at 100 m intervals extending to the 400 m midpoint. Jackrabbit use of seedings was higher during late summer than during early summer. Jackrabbit abundance was significantly higher in sagebrush habitat adjacent to a new seeding than in similar habitat away from the seeding. Our results suggest that forage availability is a factor influencing jackrabbit distribution and abundance, although predation risk may also be involved.

PART 6: HABITAT CORRELATES OF RIPARIAN BIRDS AS RELATED TO CATTLE GRAZING

1985 Objective:

To complete vegetation sampling, analyze bird count data, and write the first draft of a manuscript.

1985 Accomplishment:

Vegetation sampling was completed. Data analysis and manuscript preparation are scheduled for 1986. Also, more time will be required for analysis as a result of the decision to include information on the vegetation composition at the bird count stations from low altitude aerial photography.

PART 7: RESPONSE OF NONGAME BIRDS TO MIXED SPECIES RANGELAND SEEDING

1985 Objective:

Complete data analysis and prepare a manuscript.

1985 Accomplishment:

Data analysis was initiated, but due to personnel changes and other priorities, the work has been rescheduled for 1986.

PART 8: NONGAME BIRD RESPONSES TO TYPE CONVERSION OF SAGEBRUSH COMMUNITIES

1985 Objective:

Work with proceedings editor to publish a paper presented at the 1983 Crested Wheatgrass Symposium.

1985 Accomplishment:

A Manuscript, based primarily on reviewed literature, is currently in press and will be included in the Proceedings of the Crested Wheatgrass Symposium, Logan, Utah, 1983. The title is, "Nongame Bird Respones to Type Conversion of Sagebrush Communities" by J. Kent McAdoo, Raymond A. Evans, and William S. Longland.

The abstract follows:

When degraded sagebrush communities are converted to grasslands to improve forage production for livestock, impacts on nongame birds occur. Removal of sagebrush results in displacement of the shrub-nesting species which are dominant in degraded sagebrush habitat. However, seeding with perennial grasses results in habitat more suitable for some ground-nesting species which may increase accordingly. When successional invasion by sagebrush reaches the point where a "sagebrush-grass" community is established, relative abundance of bird species may change, resulting in a well-balanced moisture of both shrub- and ground-nesting species. This diverse bird community in a shrub-invaded seeding is a result of the more diverse vegetation structure compared to the single-layered stands of either grasses or shrubs. The time required to reach this point depends on several factors, including extent of sagebrush control, success of seeding establishment, and livestock management.

PART 9: NONGAME BIRD COMMUNITY RESPONES TO SAGEBRUSH INVASION OF CRESTED WHEATGRASS SEEDINGS

1985 Objective:

Prepare a manuscript for submission to Journal of Wildlife Management.

1985 Accomplishment:

A manuscript entitled, "Nongame Bird Community Respones to Sagebrush Invasion of Crested Wheatgrass Seedings" was sent out for peer review. The authors are J. Kent McAdoo, William S. Longland and Raymond A. Evans. The revised manuscript will be submitted to Journal of Wildlife Management in 1986. This paper includes data from both the University of Nevada Gund Research and Demonstration Ranch and the Saval Ranch Project. The abstract follows: Studies were conducted in the big sagebrush-grass ecosystem of central and northern Nevada in 1982 and 1983 to ascertain community patterns of nongame birds in shrub- and grass-dominated communities. Breeding bird populations were sampled in seven crested wheatgrass seedings at various successional stages of sagebrush invasion, as well as in four unconverted sagebrush habitats. When sagebrush-dominated areas are converted to monoculture crested

wheatgrass seedings, shrub-nesting bird species are displaced, but grass-nesting species respond favorably to the "openness" and/or the increased herbaceous cover. However, bird species diversity (BSD) decreases in response to the decreased vegetational complexity brought about by removal of the shrub layer. As successional invasion of sagebrush occurs, associated shrub-nesting bird species are restored, and grass-nesting species remain in this sagebrush-grass community. BSD therefore increases as complexity of the plant community increases through addition of another vegetation layer. The resulting BSD in invaded seedings is higher than that in surrounding unconverted sagebrush habitats with sparse herbaceous understories. Because of the dynamic nature of disturbed sagebrush ecosystems, several habitat management strategies are possible..

PART 10: WILDLIFE USE OF LOWLAND MEADOWS IN THE GREAT BASIN

1985 Objective:

Submit a paper for presentation at the North American Wildlife and Natural Resources Conference scheduled for March, 1986.

1985 Accomplishment:

This paper was prepared for the March 1986 meeting and the transactions of the meeting. It includes data from both the Saval Ranch Project and the University of Nevada Gund Research and Demonstration Ranch.

Entitled, "Wildlife Use of Lowland Meadows in the Great Basin", the paper is coauthored by J. Kent McAdoo, Gary N. Back, Mack R. Barrington, and Donald A. Klebenow.

The abstract follows:

Lowland meadows in the Great Basin comprise only a small portion of the total land area, but they provide critical wildlife habitat for many species. As with riparian habitats elsewhere, this habitat type contributes to high species diversity of both plants and animals. Inventory and research results during an eight-year period from two study areas in the northern great Basin showed that bird abundance and species richness were greater in the lowland meadow types than in adjacent upland habitats. At least 25 bird species were obligates of lowland meadows and 10 other species were most abundant in this type. Meadows were important for species considered unique because of their population status or esthetic value. Lowland meadows also provided migratory habitat for many water-birds, and were important hunting areas for raptors. Four mammal species were obligates of meadow types on our study areas. Rodents were typically more abundant in lowland meadows than in upland vegetation. The meadows were used as forage areas by deer and lagomorphs and as hunting areas for mammalian predators. At least 85% of Nevada's lowland meadows are privately owned and subject to a variety of land management practices (e.g., grazing, hay cutting, irrigation) that can affect wildlife. Economic conditions and economically based decisions influence the level of use of these ecologically important area. The combination of high quality, low quantity, private ownership, and intensive use of lowland meadows presents a challenge to wildlife managers. Holistic management of these areas is necessary to provide the needs of private landowners and to maintain the wildlife habitat requirements.

CHAPTER 7

FISHERIES RESEARCH

William S. Platts and Rodger L. Nelson

Introduction

Fisheries research study goals for fiscal year 1985 comprised continuation of time trend analyses of aquatic and streamside habitat conditions on Gance Creek with respect to dynamics of the indigenous cutthroat trout population. These goals were consistent with the overall objectives of the Saval Ranch Research and Evaluation Project and Livestock-Fisheries Interaction studies being conducted by the U.S. Department of Agriculture, Forest Service.

Specific overall objectives included:

1. Evaluate trends in streambank, streambottom, and water columm structural variables on Gance Creek under normal and non-use grazing by comparison with past information.

2. Evaluate trends in riparian vegetation structure and use on Gance Creek under normal and non-use grazing by comparison with past information.

3. Evaluate the compatibility of current and historic grazing strategies with the needs of salmonids indigenous to Gance Creek.

4. Evaluate the potential for rehabilitating and/or enhancing fishery conditions on Gance Creek to improve fish production.

5. Make recommendations with respect to optimum grazing strategies for providing high quality streamside and aquatic habitat on Gance Creek.

Specific objectives for 1985 included:

1. Collection of structural (geomorphic, aquatic, and riparian), streamside forage, hydrologic, and fish population data as in past years.

2. Compare FY 1985 data with that of past years and investigate any trends that may be emerging as our information base grows.

3. Attempt to identify and discuss any extraneous factors that may be influencing the indigenous fishery.

4. Make recommendations regarding possible refinements in study design consistent with the objectives of the Saval Project.

Accomplishments

Methods

No new techniques were added in FY 1985, though two were modified. Both embeddedness and bank cover stability were changed to actual measurement, in percent, of embedding material and stabilized streambank soil, respectively. Space limitations preclude thorough discussion of methods used, but the reader is referred to Platts et al. (in press, 1983) and Platts and Nelson (1983a) for additional information regarding overall study design and specific techniques.

Results

Water Column Parameters

As in several recent years, snowfall during the winter of 1984-85 was unusually heavy in northeastern Nevada. Runoff in the spring of 1985, however, occurred extremely quickly, resulting in low water levels during the summer sampling period (Table 7.1). Consequently, stream widths and depths were depressed in all three study sites relative to 1984 (Table 7.2), with the biggest change recorded in the upstream control (site 3). Only in this site did either width or depth approach the very low levels observed during the dry years of 1978 and 1979. Overall, midsummer levels appeared to be well within their "normal" range, which seems to be between about 5 and 7 feet in width and 0.20 to 0.30 feet in depth, and large annual fluctuations are common.

The proportion of the water column contributed by riffle continued the increasing trend it began in 1984; riffle was at its greatest abundance since 1979, another year of reduced water levels. Interestingly, the ungrazed treatment site (site 2) showed the smallest increase in riffle (9%), whereas the grazed site 3 showed the largest increase (29%); these changes were consistent with the relative changes in stream width in the three sites, showing the impact of variable flows on availability of pools needed by trout. This relationship is further illustrated by pool ratings, which dropped precipitously in all three sites in 1985 to the lowest levels yet observed; 1985 ratings depicted pools of very low quality with respect to the needs of trout. Pool feature ratings also dropped in 1985, suggesting an increase in the relative importance of instream debris as a pool forming agent, and a decline in the relative importance of channel structural features.

Streambank Parameters

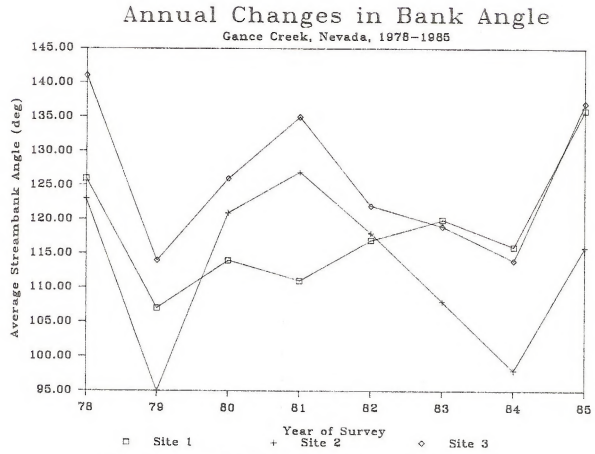
Streambank parameters showed both the impacts of high runoff on unstable banks and the need for adequate water levels to provided quality bank-related fish habitat. Streambank angles jumped sharply in all three sites, despite a recent downward trend in sites 2 and 3. In site 2, the treatment site, average angle had been approaching the desired 90 degrees that would have indicated predominantly insloped banks, but increased by 18% in 1985. Both of the control sites have consistently exhibited more outsloped banks than the treatment site, a gap that had been widening, and demonstrated a very outsloped condition in 1985. Such banks provide very little protective cover in the form of undercuts, as was clearly shown by the large decreases in average undercut (Figure 7.1). The ungrazed site 2 continued to provide the best undercut conditions, but an average level 51% below that of 1984;

Table 7.1.--Geomorphic/aquatic analysis results, Gance Creek, Nevada, 1985.

Variable	Study Site								
	Site 1			Site 2			Site 3		
	Mean	S.D.	95% C.I.	Mean	S.D.	95% C.I.	Mean	S.D.	95% C.I.
Water Column									
Stream width (feet)	6.4	0.3	5.9 - 7.0	6.8	0.3	6.2 - 7.4	5.8	0.2	5.4 - 6.2
Stream depth (feet)	0.24	0.01	0.21 - 0.27	0.22	0.01	0.20 - 0.24	0.21	0.01	0.18 - 0.24
Riffle width (percent)	65.1	4.9	55.4 - 74.8	66.8	4.0	59.0 - 74.6	73.9	4.4	65.3 - 82.4
Pool width (percent)	34.9	4.9	23.2 - 44.6	33.2	4.0	25.4 - 41.0	26.1	4.4	17.6 - 34.7
Pool quality	1.1	NA	NA	1.2	NA	NA	1.1	NA	NA
Pool feature	3.1	NA	NA	3.6	NA	NA	2.3	NA	NA
Streambanks									
Bank angle (degrees)	136	3	130 - 143	116	4	107 - 124	137	4	129 - 145
Bank undercut (feet)	0.22	.04	0.15 - 0.29	0.22	.04	0.15 - 0.29	0.11	.03	.05 - 0.17
Shore depth (feet)	.04	.01	.02 - 0.07	0.08	.02	0.05 - 0.11	.03	.01	.01 - .05
Streambottom									
Total fines (percent)									
Fines <0.03 in. (percent)	12.6	2.6	7.5 - 17.7	5.0	1.4	2.2 - 7.7	4.8	1.7	1.4 - 8.1
Fines >0.03 in. (percent)	6.9	1.8	3.4 - 10.3	8.6	2.0	4.7 - 12.5	8.3	1.9	1.4 - 12.1
Gravel (percent)	49.1	4.2	41.0 - 57.2	50.9	3.2	44.6 - 57.2	65.7	4.1	57.6 - 73.7
Rubble (percent)	29.1	3.5	22.2 - 35.9	26.0	2.9	20.4 - 31.6	18.9	3.1	12.9 - 24.9
Boulder (percent)	2.4	1.4	0.0 - 5.3	9.5	2.1	5.3 - 13.7	2.3	1.0	0.4 - 4.2
Embeddedness (percent)	58.1	2.5	53.2 - 62.9	53.3	2.3	48.9 - 57.7	47.2	2.3	42.7 - 51.7
Instream cover (feet)									
Riparian									
Stream cover	1.8	NA	NA	1.7	NA	NA	1.5	NA	NA
Bank stability	35	2	31 - 39	32	3	27 - 38	26	3	21 - 32
Habitat type	9.8	0.4	9.0 - 10.7	14.9	2.2	10.6 - 19.2	7.5	0.6	6.3 - 8.6
Vegetation use (percent)	60	4	53 - 67	15	2	11 - 19	55	4	47 - 63
Alteration (percent)									
Natural	30	1	28 - 32	41	2	37 - 44	36	1	33 - 39
Artificial	24	2	20 - 28	9	1	7 - 10	22	2	17 - 26
Total	54	NA	NA	50	NA	NA	57	NA	NA
Vegetation overhang (feet)	.00	.00	.00 - 0.01	0.12	0.04	0.04 - 0.19	0.06	0.03	-0.01 - 0.13

Table 7.2.--Summary of annual geomorphic/aquatic and riparian analysis means, Gance Creek, Nevada, 1978-1985.

Variable	Study Site 1							Study Site 2							Study Site 3						
	1978	1979	1980	1981	1982	1983	1984	1985	1978	1979	1980	1981	1982	1983	1984	1985	1978	1979	1980	1981	1982	1983	1984	1985
Water column																								
Stream width (feet)	5.1	5.2	6.0	5.9	6.3	6.5	7.5	6.4	6.0	5.6	6.5	6.1	5.9	6.4	7.6	6.8	4.5	5.5	6.4	6.2	5.6	6.7	7.3	5.8
Channel width (feet)	NA	NA	NA	NA	NA	NA	10.0	NA	NA	NA	NA	NA	NA	NA	9.5	NA	NA	NA	NA	NA	NA	NA	9.3	NA
Stream depth (feet)	0.19	0.22	0.24	0.22	0.29	0.30	0.30	0.24	0.22	0.22	0.25	0.22	0.23	0.29	0.30	0.22	0.15	0.19	0.21	0.21	0.21	0.27	0.29	0.21
Riffle width (percent)	69.4	73.7	43.1	60.6	26.4	36.8	54.7	65.1	78.4	76.6	45.3	77.8	41.5	38.8	61.4	64.6	70.6	75.3	53.1	24.1	36.2	43.5	57.5	73.9
Pool width (percent)	30.6	26.3	56.9	38.6	73.6	63.2	45.3	34.9	21.6	21.4	51.7	22.0	58.1	61.2	38.6	33.7	29.4	24.7	46.9	75.9	63.8	56.5	42.5	26.1
Pool quality	1.9	1.6	2.5	1.9	3.0	2.8	2.4	1.1	1.9	1.8	2.5	1.2	2.3	2.7	2.2	1.2	1.6	1.8	2.2	1.5	2.8	2.6	2.1	1.1
Pool feature	1.2	1.0	1.0	4.2	3.8	5.0	5.1	3.1	1.0	1.0	1.0	3.4	4.6	5.0	4.9	3.6	1.6	1.8	2.2	1.5	2.8	2.6	2.1	1.1
Streambanks																								
Bank angle (degrees)	126	107	114	111	117	120	116	136	123	96	121	127	118	108	98	116	141	134	126	126	122	119	114	137
Bank undercut (feet)	0.06	0.20	0.17	0.22	0.19	0.21	0.23	0.06	0.00	0.33	0.18	0.16	0.23	0.28	0.45	0.22	0.06	0.16	0.14	0.10	0.13	0.22	0.23	0.11
Shore depth (feet)	0.05	0.00	0.12	0.00	0.10	0.14	0.13	0.04	0.04	0.07	0.10	0.06	0.07	0.13	0.15	0.08	0.03	0.04	0.10	0.09	0.06	0.10	0.11	0.03
Fisheries rating	1.1	1.4	1.8	1.6	2.1	2.3	NA	NA	1.1	1.6	1.7	1.6	1.7	2.5	NA	NA	1.5	1.4	1.7	1.5	1.8	2.1	NA	NA
Streambottom																								
Total fines (percent)	16.6	16.2	17.6	13.4	12.0	11.1	17.1	19.5	10.3	7.0	11.5	6.6	5.9	6.9	9.7	13.6	9.1	11.2	16.5	15.4	15.7	11.8	14.1	13.1
Fines <0.85 in. (percent)	10.1	11.4	15.9	10.6	6.2	6.9	13.9	12.6	5.6	4.5	9.3	5.6	2.2	3.9	5.5	5.0	1.2	4.2	14.0	9.6	7.1	7.2	8.0	4.8
Fines >0.85 in. (percent)	6.5	4.8	1.7	2.8	5.8	4.2	3.2	6.9	4.7	2.5	2.2	1.0	3.7	3.0	4.2	8.6	7.9	6.4	3.7	5.8	8.6	4.7	6.1	8.3
Gravel (percent)	78.2	67.2	70.7	74.0	72.5	67.4	60.7	49.1	80.3	63.6	66.6	72.0	67.4	56.5	51.2	50.9	86.2	78.3	74.0	79.0	69.6	68.6	60.7	63.7
Rubble (percent)	5.3	13.1	9.4	10.8	13.4	20.9	20.0	29.1	8.3	22.5	14.3	14.1	18.2	26.2	26.4	26.1	3.0	6.3	3.1	1.8	1.7	13.7	19.2	16.5
Boulder (percent)	1.3	3.2	2.3	1.7	2.1	1.7	2.3	2.4	1.1	7.3	7.7	7.3	8.5	11.0	12.9	9.5	1.7	4.3	3.6	2.1	3.6	5.8	6.1	2.3
Embeddedness (rank)	3.1	3.5	2.1	3.4	2.4	2.9	2.6	NA	3.6	4.0	2.7	4.3	3.1	2.7	2.6	NA	3.8	4.2	3.1	3.9	2.7	2.9	2.4	NA
Embeddedness (percent)	NA	NA	NA	NA	NA	NA	NA	56.1	NA	NA	NA	NA	NA	NA	NA	53.3	NA	NA	NA	NA	NA	NA	NA	47.2
Instream cover (feet)	0.3	0.3	0.2	0.0	0.6	0.4	0.5	0.2	0.1	0.3	0.3	0.0	0.2	0.3	0.2	0.1	0.3	0.6	0.3	0.0	0.4	0.5	0.5	0.1
Riparian																								
Stream cover	2.7	3.0	1.9	2.4	2.7	2.0	2.3	1.8	2.4	2.5	1.9	1.9	2.5	1.8	2.4	1.7	2.7	2.5	1.8	1.9	2.4	1.8	2.2	1.5
Bank stability (rank)	1.3	1.9	2.2	2.1	2.5	2.4	2.3	NA	1.4	1.6	2.3	2.1	2.9	2.2	2.2	NA	2.2	1.6	2.2	2.0	2.5	1.9	2.2	NA
(percent)	NA	NA	NA	NA	NA	NA	NA	35.0	NA	NA	NA	NA	NA	NA	NA	32.2	NA	NA	NA	NA	NA	NA	NA	26.2
Habitat type	6.8	12.1	10.4	12.4	15.2	NA	NA	9.8	6.1	7.9	10.1	12.1	15.4	NA	NA	7.1	12.0	8.5	10.6	10.8	13.5	NA	NA	7.5
Vegetative use (percent)	65	73	66	75	55	42	11	60	53	15	+5	+55	1	0	0	0	59	46	47	75	56	35	2	55
Alteration (percent)																								
Natural	29	27	32	27	33	25	37	30	30	32	36	30	24	28	39	41	31	29	33	25	27	25	42	36
Artificial	21	14	16	17	13	17	9	24	15	9	0	11	7	1	2	9	50	42	45	40	43	33	50	58
Total	50	41	48	44	46	37	46	54	45	41	36	41	31	29	41	50	81	71	78	65	70	58	92	94
Vegetation overhang (percent)	0.09	0.18	0.07	0.15	0.33	0.18	0.06	0.00	0.14	0.12	0.14	0.13	0.37	0.18	0.07	0.12	0.06	0.08	0.14	0.06	0.25	0.97	0.05	0.04
Canopy (degrees)	NA	NA	NA	NA	40	48	NA	NA	NA	NA	NA	NA	26	24	NA	NA	NA	NA	NA	NA	38	33	NA	NA
Light intensity (percent)	NA	NA	NA	NA	61	71	NA	NA	NA	NA	NA	NA	60	56	NA	NA	NA	NA	NA	NA	59	67	NA	NA



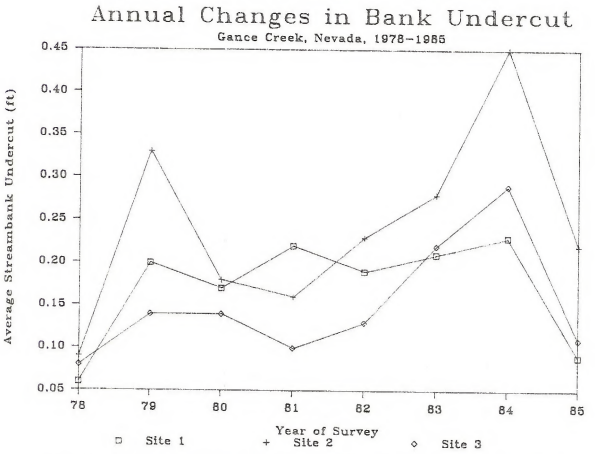


Fig. 7.1. Annual changes in bank angle and undercut, Gance Creek.

sites 1 and 3 recorded declines in average undercut of 61 and 62 percent, respectively. With so little undercut and such large bank angles, average streamshore depths inevitably decreased also, and were at the lowest levels recorded since the study began; however, the ungrazed treatment site had at least twice the average undercut of either control. Gance Creek has been shown to undergo rather large-scale deposition and scouring (Platts et al. 1985; Platts and Nelson 1983a), and it was noted by personnel onsite that the channel appeared to have entrenched itself relative to 1984. This, of course, can lead to dramatic changes in streambank parameters from year to year, and may explain many of the changes described above. All in all, streambank conditions were very poor in 1985.

Streambottom Parameters

High spring runoff effects were again evident from streambottom conditions. Gance Creek is known to undergo sharp changes in channel profile caused by its variable flows (Platts et al. I985; Platts and Nelson 1983b), which also causes changes in surface substrate composition and embeddedness. In 1985, gravel abundance continued a generally declining trend that began in about 1981 (Figure 7.2), approximately the time exceptionally high spring flows become a usual occurrence. Despite the fact that gravel continues to comprise approximately half the surface substrate composition throughout the study area, it has fallen from a high of 86.2% in site 3, a high of 80.3% in site 2, and a high of 76.5% in site 1. The smallest change has occurred in the higher gradient site 3 (23%), while sites 2 and 1 have recorded declines of 37 and 36 percent, respectively. Gravel provides the bulk of the spawning habitat for stream-dwelling cutthroat trout, as well as food production sites, so its apparent declining trend should be monitored carefully.

Concurrently, fine sediments (total) have been gradually increasing in abundance in the upper two sites while returning to earlier high levels in site 1 following 2 years (1982 and 1983) of relative scarcity. Site 1 has the lowest channel gradient of the three study sites, as we)l as the most pool area, and is consequently an area of inherently increased sedimentation. Fine sediments eroded from the surrounding watershed that make their way into Gance Creek tend to settle in increasingly large quantities as distance downstream through the study area increases because channel slope declines and pool increases along this downstream gradient. Since fine sediments tend to impair trout reproductive success and reduce the streambottoms food production potential, these recent increases should be cause for concern.

Rubble continued to be an important surface substrate component. Although it has remained relatively stable in sites 1 and 2 over the past several years, it has increased markedly in site 3 since 1981 and has shown a generally increasing trend in site 1 since the study began. It seems obvious that high flows have washed gravel from site 3 whereas the larger rubble particles were able to stay in place with some, perhaps, being deposited from upstream sources. Rubble provides essential trout fry protective cover and food resources, and its abundance is welcome.

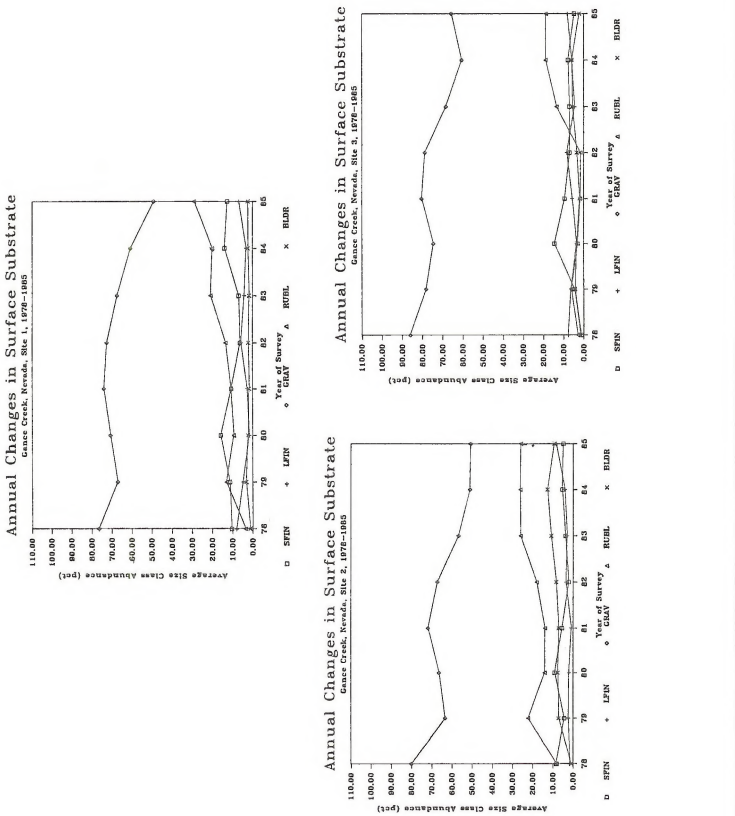


Figure 7.2. Annual fluctuations in average relative abundances of surface substrates, by site, Gance Creek, Nevada.

Boulder continued to represent a relatively unimportant streambottom component, except in the treatment site, where its abundance has increased considerably since 1978. Boulders provide cover for stream-swelling trout, and are potentially an important source of cover where other forms of cover (eg. undercuts) are unavailable.

Instream vegetative cover continued to be essentially absent from Gance Creek, and was especially scarce in 1985. In no site did instream vegetation cover comprise more, on average, than 3% of the wetted stream width.

Riparian Vegetation Parameters

Riparian conditions along Gance Creek can be described simply as marginal and in need of improvement (Tables 7.1 and 7.2), a condition that has been compounded by recent high runoff events. All vegetative condition ratings (habitat type, stream cover, and bank cover stability) have declined over the past several years as a result of streambank erosion and consequent increases in exposed streambank soils. This effect is shown most clearly by the modified bank cover stability measurements, which showed the greatest average bank cover (site 1) to be only 35% (eg. 65% exposed). Such streambanks are poorly stabilized and not resistant to high runoff events, as demonstrated by recent increases in total bank alteration (Figure 7.3); concurrent increases in artificial alteration indicate increased susceptibility to grazing damage under these marginal conditions.

Vegetation use in the grazed control sites was high (greater than 50%), but not far outside the bounds of normal range management goals. Under marginal streambank conditions and in the presence of additional ecosystem stress applied by unusually high runoff events, however, such harvest levels are unlikely to encourage rehabilitation or help maintain quality riparian conditions with respect to trout fishery needs. In addition, the scheduled cattle use that occurred within the supposedly ungrazed exclosure in 1985 will most likely retard the habitat improvement that appears to be beginning in site 2.

Interestingly, vegetative overhang was not reduced by high runoff in the two upper sites and, in fact, increased in both. The upper control, however, showed only a small increase (17%) compared with the large increase in the protected treatment site (71%). Unfortunately, even with these apparent improvements since last year, vegetative overhang averaged less in all sites than it has for most of the 8-year study period, and was virtually nonexistent in site. 1.

Streamside Herbage Analysis

Graphing of 1985 herbage meter readings against green vegetation weights suggested a linear relationship (Figure 7.4), and a linear model was fit to the data (Table 7.3). As in previous years the linear model provided a very good fit on Gance Creek, with 81% (R^2) of the variation in 1985 green weights explained by the regression. Residual error ($S_{y.x}$) was quite low in 1985, suggesting considerable homogeneity in the vegetation.

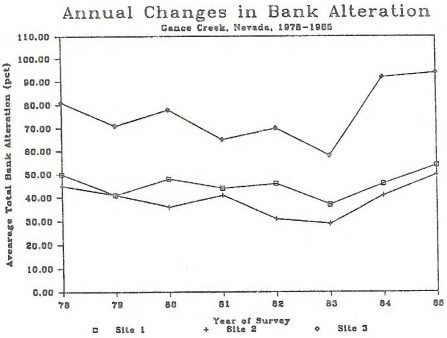

Annual Changes in Bank Alteration
Gance Creek, Nevada, 1978-1985
Average Total Bank Alteration (pct)
110.00
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
78
79
80
81
82
83
84
85
Year of Survey
Site 1
Site 2
Site 3

Fig. 7.3.

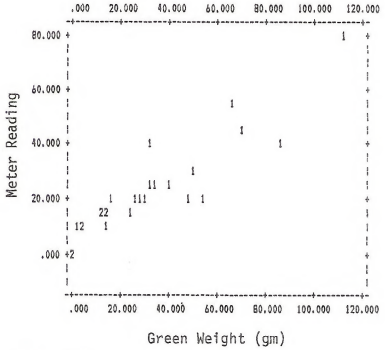

.000
20.000
40.000
60.000
80.000
100.000
120.000
Meter Reading
Green Weight (gm)

Fig. 7.4.

Because of unauthorized grazing within the exclosure surrounding site 2, comparison of ungrazed forage yield with the grazed yield in sites 1 and 3 is impossible, but standing yield and apparent differentials between sites, are, however, included in Table 7.3. Forage yield appears to have been very low in 1985, possibly a consequence of reduced summer precipitation and low flows.

Hydrologic Analysis

Hydrologic analyses have been conducted each year since 1978 (1979 was sampled only partially), and wide fluctuations in hydrologic parameters (Table 7.4) and stream cross profiles have been the rule (Platts and Nelson 1983; Platts et al. 1985).

Fish Populations

The cutthroat trout population (Table 7.5) in Gance Creek seems to oscillate with some regularity (Platts and Nelson 1983), and began an expected decline in 1985 (Table 7.6; Figure 7.5). Factors regulating this cyclic behavior are currently unknown, but density-dependent factors are suggested by the fluctuations in population condition (Figure 7.6). Minimal population condition generally occurs during high population sizes, precipitating a decline in population size through a weakened young-of-the-year class, and an accompanying increase in overall condition the following year. It does appear, however, that habitat factors may provide a modifying effect. Trout populations in the ungrazed treatment site seem to have responded to the apparently improving habitat conditions relative to the control sites to the extent that site 2 supports the greatest populations. This situation is even more dramatic in terms of standing crop, or density, (in numbers per square foot to account for differing water column capacities between sites), with site 2 supporting a considerably higher trout density than either of the grazed control sites. Trout biomass in the ungrazed treatment site did not exceed biomass in the control sites; young-of-the-year trout apparently find conditions most favorable within the exclosure and comprised the greatest proportion of the population therein.

Table 7.3.--Summary of annual streamside herbage analysis results, Gance Creek, Nevada, 1979-1985.

	Linear Regression					Forage Yield (lb/acre)			Differential	Percent
Year	N	A	B	R^2	S(y-x)	Site 1	Site 2	Site 3	2-1	2-3
1979	15	-0.08	0.03	0.88	0.14	470	490	NA	4	NA
1980	17	0.21	0.07	0.83	0.72	1,413	2,761	1,541	49	44
1981	16	0.04	0.04	0.89	0.12	470	619	544	24	12
1982	24	0.08	0.04	0.87	0.44	906	1,530	611	41	60
1983	22	0.46	0.01	0.72	0.42	1,036	1,345	981	23	27
1984	24	0.10	0.02	0.90	0.34	1,118	1,240	799	10	36
1985	26	0.16	0.02	0.81	0.26	635	971	637	35	34

Table 7.4.--Summary of 1985 hydrologic analysis results, Gance Creek, Nevada.

Variable	Study Site		
	Site 1	Site 2	Site 3[1/]
Slope (pct)	1.7	2.9	1.9
Wetted area (ft^3)	1.3	1.5	1.2
Wetted perimeter (ft)	6.4	6.3	6.1
Wetted width (ft)	6.2	5.5	5.8
Wetted depth (ft)	0.23	0.29	0.22
Wetted hydraulic radius	0.22	0.26	0.20
Wetted flow (ft^3/sec)	0.80	0.73	0.57
Wetted velocity (ft/sec)	0.69	0.49	0.58
Stream power	0.14	0.29	0.14
Manning	0.012	0.048	0.40

[1/]Data analysis based on only 9 transects, rather than 10 transects as with sites 1 and 2.

Sculpin numbers continued an increasing trend begun in 1983, and for the first time since 1978 they outnumbered trout. Sculpin typically prefer streambottom conditions similar of those of trout, so this situation should not be construed as indicating deterioration in streambottom conditions; it is possible, however, that they are responding to the increasing proportion of riffle areas in the water column, which some species of sculpin are known to prefer (Bailey 1952; Brynildson and Brynildson 1978).

Summary

The variable nature of Great Basin streams and the impacts of high spring runoff continued to express themselves on Gance Creek. As could be expected, the greatest changes occurred in streambank and riparian vegetation conditions, though important changes in streambottom conditions were also evident. Continued high fish populations indicate that conditions are at least suitable to maintaining a fishery, but do not suggest that conditions could not be improved. From a recreational standpoint, a larger proportion of catchable size individuals would be welcomed, which would require improved cover suitable to adult fish. This would include improving streambank conditions to provide more undercut and streamshore depth and more overhanging vegetation, which would first require stabilizing the banks. Total fine sediments are presently above optimal levels with respect to food production (10%; Hickman and Raleigh 1982), and appear to be increasing. In addition, although the absolute abundance of fine sediments as a particle size class was within the 5 to 30% range considered optimal for cutthroat trout reproduction

Table 7.5.--Summary of 1985 fish population analysis results, Gance Creek, Nevada, 1985.

Variable	Study Site: Site 1 Mean	Site 1 S.D.	Site 1 95% C.I.	Site 2 Mean	Site 2 S.D.	Site 2 95% C.I.	Site 3 Mean	Site 3 S.D.	Site 3 95% C.I.
Cutthroat trout									
Total catch	133	NA	NA	203	NA	NA	161	NA	NA
Population estimate	136	2	133 - 141	206	2	203 - 210	164	2	161 - 169
Mean length (in)	4.15	0.14	3.87 - 4.43	3.65	0.11	3.44 - 3.87	3.79	0.12	3.55 - 4.03
Mean weight (oz)	0.58	0.07	0.45 - 0.71	0.41	0.05	0.32 - 0.50	0.44	0.05	0.33 - 0.55
Estimated biomass ($oz/ft^2[x10^{-2}]$)	2.0	NA	NA	2.1	NA	NA	2.1	NA	NA
Estimated standing crop									
($\#/ft^2[x10^{-2}]$)	3.5	NA	NA	5.1	NA	NA	4.7	NA	NA
(#/mile)	1197	NA	NA	1813	NA	NA	1443	NA	NA
Population condition	1.0	NA	NA	0.9	NA	NA	0.9	NA	NA
Sculpin									
Total catch	155	NA	NA	204	NA	NA	185	NA	NA
Population estimate	275	64	155 - 402	436	128	204 - 688	303	54	196 - 410
Observed standing crop									
($\#/ft^2[x10^{-2}]$)	4.0	NA	NA	5.0	NA	NA	5.3	NA	NA
(#/mile)	1364	NA	NA	1795	NA	NA	1628	NA	NA
Dace									
Total catch	1	NA	NA	0	NA	NA	1	NA	NA
Population estimate	1	0	1 - 1	0	NA	NA	1	0	1 - 1
Observed standing crop									
($\#/ft^2[x10^{-2}]$)	0.0	NA	NA	0.0	NA	NA	0.0	NA	NA
(#/mile)	9	NA	NA	0	NA	NA	9	NA	NA

Table 7.6.--Summary of annual fish population analysis results, Gance Creek, Nevada, 1978-1985.

Species/Variable	Study Site 1								Study Site 2								Study Site 3							
	1978	1979	1980	1981	1982	1983	1984	1985	1978	1979	1980	1981	1982	1983	1984	1985	1978	1979	1980	1981	1982	1983	1984	1985
Cutthroat Trout																								
Total catch	32	175	303	203	183	156	325	133	64	184	294	288	170	162	308	203	110	214	472	524	126	201	376	161
Population estimate	32	181	329	207	191	166	375	136	64	203	303	299	185	164	329	206	113	235	509	533	143	206	383	164
Mean length (in)	4.47	2.42	2.66	3.79	3.87	3.86	2.61	4.16	3.57	2.19	2.82	3.73	3.72	3.14	3.14	3.46	2.64	1.96	2.05	2.56	2.62	2.32	2.42	3.29
Mean weight (oz)	0.92	0.39	0.41	0.40	0.38	0.37	0.18	0.58	0.23	0.11	0.17	0.23	0.23	0.19	0.18	0.41	0.22	0.11	0.14	0.26	0.17	0.18	0.17	0.44
Estimated biomass (oz/ft^2)[x10^{-2}]	1.0	2.3	3.8	2.4	1.6	1.3	1.3	2.0	1.3	1.9	4.0	1.9	1.2	1.1	1.2	2.1	0.9	0.6	3.4	2.5	0.8	1.1	1.7	2.1
Estimated standing crop (yr/ft^2)[x10^{-3}]	3.0	5.6	9.3	5.8	5.0	4.3	7.3	3.5	1.8	4.0	7.8	8.2	5.3	3.7	8.3	5.1	4.1	7.3	33.2	14.3	4.3	5.2	8.7	4.7
(#/mile)	162	1599	2636	1622	1681	1461	2896	1197	563	1760	2668	2621	1614	915	3220	1713	937	2362	4483	4695	1258	1813	3370	1443
Population condition factor	1.0	0.8	0.9	1.0	1.4	1.3	0.6	1.0	1.0	0.8	0.9	0.9	1.4	1.1	1.1	0.9	1.1	0.7	0.9	0.9	1.4	1.0	0.9	0.9
Sculpin																								
Total catch	203	37	53	37	56	43	100	155	1	2	5	27	29	8	24	104	0	1	0	0	0	2	16	185
Population estimate	203	25	54	36	135	47	116	275	NA	NA	5	27	47	9	45	436	NA	NA	NA	NA	NA	2	16	303
Mean weight (oz)	0.05	0.2	NA	0.2	0.16	0.23	NA	NA	0.49	0.17	NA	0.17	0.23	0.28	NA	NA	NA	NA	NA	NA	NA	0.39	NA	NA
Obs. biomass (oz/ft^2)[x10^{-2}]	0.3	0.1	NA	0.2	0.4	0.3	NA	NA	<0.1	<0.1	NA	0.1	0.2	0.2	NA	NA	NA	NA	NA	NA	NA	<0.1	NA	NA
Obs. standing crop (oz/ft^2)[x10^{-3}]	6.6	0.5	1.4	1.2	2.5	1.7	2.6	4.0	<0.1	0.1	0.1	0.7	1.3	0.2	0.1	5.0	NA	<0.1	NA	NA	NA	0.1	0.4	5.3
(#/mile)	1788	150	486	326	827	578	886	1364	9	10	44	238	255	77	201	1795	0	9	0	0	0	18	141	1628
Dace																								
Total catch	0	0	0	0	0	0	1	0	0	4	0	0	0	0	0	0	0	0	0	0	0	4	1	
Population estimate	NA	NA	NA	NA	NA	NA	1	NA	NA	6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6	1	
Mean weight (oz)	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.17	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Obs. biomass (oz/ft^2)[x10^{-2}]	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Obs. standing crop (oz/ft^2)[x10^{-3}]	NA	NA	NA	NA	NA	NA	<0.1	NA	NA	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.1	
(#/mile)	NA	NA	NA	NA	NA	NA	9	NA	NA	35	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	35	9

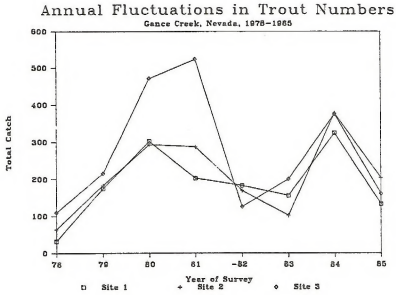


Figure 7.5. Annual fluctuations in observed cutthroat trout abundance, Gance Creek, Nevada.

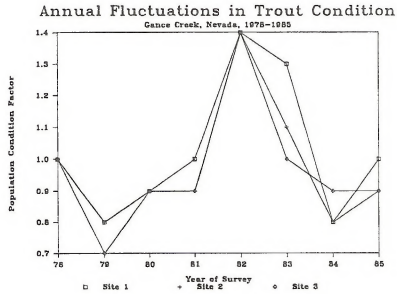


Figure 7.6. Annual fluctuations in average cutthroat trout condition factor, Gance Creek, Nevada.

(Hickman and Raleigh 1982), embeddedness, which measures the actual debilitating effect of fine sediments, was quite high in all sites. Consequently, we believe that considerable improvements in spawning, rearing, and energy productivity of the streambottom could be made.

Increasing numbers of sculpin in Gance Creek pose some interesting questions. While the increase itself probably does not indicate any serious downturn in habitat conditions with respect to trout needs, there is some chance that large increases in sculpin numbers could adversely impact trout populations through egg predation or competition for aquatic food organisms. Since the predation on trout eggs by sculpin has not been shown to pose serious problems elsewhere, sculpin, in fact, often providing as much as or more prey themselves than they consume (Brynildson and Brynildson 1978; Dineen 1951; Koster 1937), this is probably not a serious consideration unless invertebrates were scarce and trout fry were abundant. It is more conceivable that large numbers of sculpin could substantially reduce invertebrate prey populations, even to the point that they become a limiting resource with respect to the young-of-the-year trout. Since they are a natural component of a relatively non-diverse system, controlling their numbers should not be considered.

Although grazing use has generally been near 50%, which normally considered acceptable range use, it has at times been well over 70 percent in the more heavily used site 1. This use level is not benefitting streamside conditions, either structurally or vegetationally. Improvements in vegetal conditions would surely help stabilize streambanks and reduce the impacts of unusually high runoff events, which seem to be becoming annual events. This situation seems to be ocurring within the protected site, but the process is slow and additional study is needed to fully evaluate the recovery process. At any rate, it appears that, with respect to fishery and riparian habitat needs, improvements in grazing management could be made.

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CHAPTER 8

LIVESTOCK

PART 1: THE SELENIUM STATUS OF RANGE CATTLE IN NORTHEASTERN AND CENTRAL NEVADA

S.C. Poole, V.R. Bohman, L.A. Rhodes and R. Torrell

The following is adapted from a paper given at the Western Section, American Society of Animal Science:

Introduction

Selenium (Se) occurs normally and physiologically in very small amounts in all of the cells and tissues of the animal body. It is organically bound and is highly effective in the prevention and cure of a variety of fatal deficiency diseases (Underwood, 1977; Schwartz, 1961).

Selenium deficiency in ruminants can result in reduced growth, poor reproductive performance in older animals and nutritional muscular dystrophy, also known as white muscle disease, in lambs and calves. Toxic levels of Se are characterized by emaciation, elongation and soreness of the hoof, stiffness, blindness and some degree of paralysis (McDowell et al., 1983). Much of the tissue Se is highly labile and concentrations in tissues reflect dietary Se intake, particularly when provided by natural constituents of the diet (NAS, 1980). Critical plasma Se levels have been reported by several workers. Levels of 0.002 - 0.008 µg/ml plasma Se for cattle on a deficient diet and 0.02 - 0.04 µg/ml for cattle on a marginal diet have been reported by Puls (1981). McDowell (1983) considers 0.030 µg/ml plasma Se to be the critical level for this element. This thus provides an opportunity to ascertain the Se status of grazing cattle on a heterogeneous diet by the composition of animal tissues.

Because Se is a significant micronutrient in production agriculture (Anderson et al., 1961), knowledge of the Se status of range lands and range animals is important. In the Northwestern portion of the United States, Se is known to vary in concentration in soils and plants. Very low concentrations of Se occur along the Pacific coast region of Washington, Oregon and northern California while low concentrations of Se occur in eastern Washington, northern Idaho and western Montana. Variable concentrations of Se are reported in eastern Oregon, central and southern Idaho and northern Nevada (Kubota et al., 1967; Carter et al., 1968; Kolleret al., 1983). In Nevada, soil and Se-accumulator plant surveys have revealed a variety of Se levels across the state (Beath et al., 1939; Lakin et al., 1948).

The Se concentration in plants is dependent on the presence and availability of the element in the soil. The distribution of Se in soils is dependent on the Se content of the parent material before pedogenic processes alter the composition (Jenkins and Wynn Jones, 1980). Soil parent materials capable of producing vegetation with Se levels toxic to livestock are invariably sedimentary deposits with shales predominating. Igneous rocks, which are inherently low in Se, constitute the majority of Se-deficient soil parent materials. Selenium content of sandstones are variable and Se in limestone

are generally low (Fleming, 1980). Studies of toxic and nontoxic seleniferous soils have shown that Se availability to the plant from the soil are dependent on climate and soil-development process (Lakin, 1961). As with other soil-borne elements, total Se in soil is not always a useful indicator of plant available Se (Johnson, 1975).

In Nevada, range cattle represent an important industry. A review of the literature shows that little information is available on the Se status of range cattle in Nevada. The purpose of this study was to measure the plasma Se of range cattle at the Saval Ranch in northeastern Nevada and the Gund Ranch in Central Nevada and to evaluate this data as it relates to the Se status of grazing cattle. The Saval Ranch is located approximately 40 miles north of Elko, near the North Fork of the Humboldt River. The Gund Ranch is northeast of Austin, along the Lander and Eureka County borders. Soil types and their respective parent materials associated with the grazing areas were identified.

Experimental Procedure

Blood samples were collected from mature and yearling cattle at the Saval Ranch at the conclusion of grazing periods on crested wheatgrass seedings, Bureau of Land Management native and Forest Service native pastures. Blood samples were collected from similarly age cattle at the Gund Ranch at the beginning and the end of a 6-week grazing period. Samples were collected in heparinized tubes from the jugular vein and transported on ice to Reno where they were centrifuged for plasma collection. Samples were stored at -20C until analysis.

Plasma samples were analyzed by a variation of the method of Oster and Prellwitz (1982). Plasma aliquots were added to a nickel nitrate (Ni^{2+}) solution (4 gm Ni/liter:1% nitric acid) and mixed on a Vortex mixer to obtain a homogeneous solution. The absorbance of the solutions was measured using electrothermal atomic absorption spectrophotometry (ETAAS) (Instrumentation Laboratory (IL) 555 Flameless Atomizer and IL 251 AA/AE Spectrophotometer), Absorbance readings were repeated until two values within 10% of each other were obtained. All other parameters for the measurement of Se were according to manufacturers' specifications (Emmel et al., 1976). National Bureau of Standards (NBS) Reference Material 8419 was used to verify the accuracy of the methodology. All glassware was washed with dilute nitric acid and rinsed with deionized distilled water. Analysis of variance (ANOVA) was computed using statistical packages of the University of Nevada Computing System (Cyber 830).

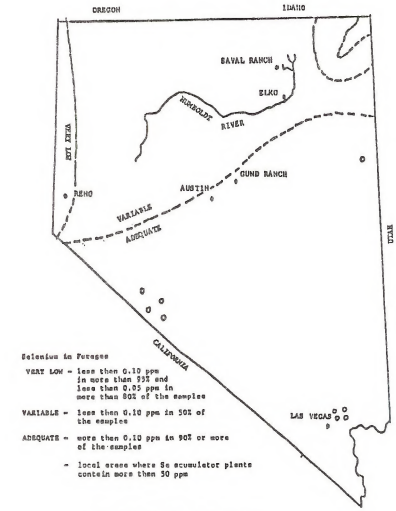
Results and Discussion

The plasma Se levels of the cattle from both locations are shown in Table 1. The cattle from northeastern Nevada had lower levels of plasma Se than the cattle from the central part of the state ($P<.01$). Yearlings had a tendency to have higher levels of plasma Se than the mature cattle ($P<.1$) at the Elko location. This trend did not occur in cattle form central Nevada. At both locations differences between periods were small.

TABLE 8-1. Average plasma selenium levels of grazing cattle

Class of Cattle	Periods	Saval	Gund
		µg/ml	
Cows	1	0.016 ± 0.005	0.029 ± 0.006
	2	0.021 ± 0.008	0.029 ± 0.006
	3	0.021 ± 0.005	
Yearlings	1	0.024 ± 0.010	0.030 ± 0.004
	2	0.022 ± 0.008	0.026 ± 0.004
	3	0.025 ± 0.008	
Means		0.022	0.029*

*Statistically different at P<.01.


OREGON
IDAHO
SAVAL RANCH
ELKO
HUMBOLDT RIVER
CARSON RIVER
RENO
AUSTIN
GUND RANCH
VARIABLE
ADEQUATE
UTAH
CALIFORNIA
LAS VEGAS
Selenium in Forages
VERY LOW - less than 0.10 ppm in more than 95% and less than 0.05 ppm in more than 80% of the samples
VARIABLE - less than 0.10 ppm in 50% of the samples
ADEQUATE - more than 0.10 ppm in 90% or more of the samples
- local areas where Se accumulator plants contain more than 50 ppm

SELENIUM CONTENT OF FORAGES IN NEVADA

Fig. 8-1.

McDowell et al. (1983) has listed critical levels of minerals in the tissues of animals to ascertain the nutritional status of animals as it relates to mineral metabolism. For grazing cattle, the critical levels of serum is 0.030 ug/ml. Underwood (1977) has indicated that whole blood is higher in Se than Serum. He reported that 0.080 µg/ml whole blood Se was adequate for normal healthy cows.

In his guide for Canadian workers, Puls (1981) stated that serum Se indicates a deficiency at levels of 0.009 - 0.050 µg/ml and elsewhere that cattle on a marginal diet 0.020 - 0.040 µg/ml. California workers (Norman et al., unpublished data) have suggested a critical level of blood Se of 0.04 µg/ml.

If McDowell's criteria are used, 86% of the plasma samples from the Elko County cattle had plasma levels less than 0.030 µg/ml. Approximately half of the cattle in central Nevada had levels this low.

The Se content of animal feedstuffs varies with plant species and geographical area of production. The concentration of Se in plants will be governed primarily by the presence and availability of the element in the soil (NRC, 1983). The availability of soil Se to plants depends on rainfall, drainage, aeration, pH and sesquioxide content of the soil (Johnson, 1975). Ruminant animals absorb only about 40% of dietary Se (Marier and Jaworski, 1983). The differences in geographical soil types and their respective parent materials may therefore account for the differences in plasma Se levels between the Saval Ranch and the Gund Ranch.

The soils of the northeastern location are derived from the Independence Mountain Range in the northern part of the Basin and Range province, south of the Snake River Plains. Ordovician siliceous cherts, shales, quartzites and conglomerates are the major rock types of the range. Silurian and Mississippian limestones overlie the Ordovician sedimentary rocks in some areas. The soils of the mountains and foothills were formed in residual or colluvial parent materials weathered from various rock sources (Kerr 1962 USDA-SCS 1979).

The soils of the central Nevada site are derived from mixed rock sources of the Simpson Park Range which lies between the Cortez Mountains and the Roberts Mountains. A assemblage of chert, shale and quartzite assigned to the Vinni formation, consisting of undivided Silurian and Ordovician sedimentary rocks and other unnamed Silurian and Ordovician units, constitute the majority of rocks in the range. Volcanic and pyroclastic rocks underlie much of the northern and southern parts of the range (Roberts et al. 1958, Roberts et al. 1967, USDA-SCS 1978).

Soil parent materials at the northeast location and central locations are derived from rocks of approximately the same age and type. Apparently, there are differences in Se intake by animals on the two sites. Kubota et al. (1967) notes that Se is randomly distributed throughout much of Nevada. Areas of variable plant Se concentrations include many closed basins filled with alluvium and lacustrine sediments interspersed with mountain ranges of volcanic rocks, granites and sedimentary rocks. A Se deficient area may be evident in high elevations of mountains such as those adjacent to the Humboldt River Valley.

Forage type probably plays a minor role in forage Se content under these conditions. The same plant species, crested wheatgrass, was the dominant forage for the cows when sampled at the period 1 in Elko County and period 2 in central Nevada but a marked difference existed in plasma Se levels. This suggests that geographical area rather than plant type is the dominant factor affecting these differences.

In a study of the Se content of forage in the northwest, Carter et al. (1968) proposed a regional mapping the Se status of five northwestern states. Alfalfa was used as the key plant for sampling because of its wide use as both forage and hay. Where alfalfa was not available, grasses, other legumes or grass-legume mixtures were sampled. In relation to the map, the Saval Ranch lies in a variable Se area and the Gund Ranch is in an adequate Se area (Figure 1). Further studies of the animal, plant and soil Se relationships are needed to better understand the differences between the two locations.

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CHAPTER 9

REMOTE SENSING

Rangeland Vegetation Changes Measured From Helicopter-borne 33mm Aerial Photography

Paul T. Tueller, Peter Lent, Robert D. Stager,
Edith Jacobsen and Karen Platou

Rangeland managers are being required to rely heavily on monitoring as a basis for management decisions. Of great importance, in the monitoring process, is the requirement to periodically measure long-term or successional vegetation changes. This important consideration led us to evaluate large-scale vertical aerial photography as a means of measuring vegetation changes on the Saval allotment. Such large-scale photography has the potential to provide cost-effective monitoring data if the proper scale of photography is available and if the important species can be identified.

The study sites for this investigation consist of 6 transects on the Saval Ranch each located in representative ecological sites as follows: 1) Wet Meadow, 2) Wet Meadow, 3) Loamy 10-12", 4) Loamy Slope, 5) Clay Pan and 6) South Slope. Two of the sites are in wet meadows and other four are sagebrush/grass ecological sites. The Clay Pan ecological site is dominated by Artemisia longiloba while the other three sagebrush/grass ecological sites are dominated by Artemisia tridentata vaseyana.

For this study we obtained all aerial photography from a Bell B-1 helicopter chosen because of its good forward visibility, maneuverability and relatively modest cost. All photos were taken with motor driven 35mm cameras and 120mm lenses. The motor driven camera provided a sample of 5 to 10 photographs to be taken along each transect. The 120mm lens allowed the photographer to obtain photographs of a suitable scale by aiming the camera between the bubble of the helicopter and the skid.

Photographs were taken from altitudes of 350 ft. and 650 ft., giving representative fraction scales of 1:960 and 1:1650. One transect per study site was flown in both 1981 (Dr. Merle Meyer, photographer) and 1985 (Dr. Paul Tueller, photographer). Each transect was photographed with both color (Kodachrome 400) and color infrared (Kodak Ektachrome Infrared Film 2236). A 2 ft. by 4 ft. yellow plexiglas marker was placed at one end of each transect. These markers were easy to see from the air and had not deteriorated after four years in the field.

The ground area sampled in each photograph represented an area 100 ft. by 30 ft. Within this representative ground sample area several kinds of counts and measurements were made from the photographs. Plant density was recorded on three belt transects representing 6 ft. by 100 ft. on the ground. Nested frequency of occurrence was recorded on three frame sizes representing 1.5 ft. by 1.5 ft., 1.5 ft. by 3 ft., and 3 ft. by 3 ft. on the ground. Also, within this area, dot grids and ocular estimates were used to estimate cover of

identifiable species and ground cover attributes. For the dot grid, 1800 dots were sampled for hits and ocular estimates were made to the nearest percentage point with help of estimation guides of 2 and 5% of the plot area.

All counts, cover estimates and frequency determinations were made from the 35mm slides by projecting the ground sample areas onto a grid. The grid was drawn on clear, white paper and placed onto a wall. The focused image sizes were adjusted so that each slide had the same scale. Appropriate statistical tests were completed on the results.

Production and frequency of occurrence data were collected on the ground in the same locations and years and were used to "ground truth" the aerial data. These data were not evaluated statistically. Actual observed ground changes and their significance are presented in a paper being prepared for publication.

RESULTS

We found that ground sampling allowed a more detailed look at all the species on the site. Many species are sparsely distributed or are infrequent enough that while they are on the transects studies they are seldom sampled. In this study, we were able to consistently identify and measure an average of 7.1 species per site on the photographs. While ground sampling for species frequency, we encountered 16.5 species per site. There was an average of 28 species of higher plants on each site. Most shrub species were among those identified. This was felt to be important since these are the dominant species on each site and are influential in the successional status of the plant community. Only a few grasses, mainly the prominent brush grasses were identified.

It is not feasible to present the many, detailed results here, we have summarized the major findings and conclusions.

1. Of all the sampling methods used, species density counts on the photographs revealed the least amount of reliable or consistent information.

2. Methods for cover consistently provided the most reliable information. The dot grid method collecting cover data being objective may be slightly more accurate than ocular estimation.

3. Species frequency determinations particularly with the larger frame sizes also was a reasonably useful and sensitive method.

4. Color-infrared photography appeared to be slightly more sensitive for identification of litter, dead shrubs, and bare ground. The color-infrared film was inconsistent for improving species identification although this film type adds enough extra information to suggest the need for studying and interpreting both color and color-infrared film simultaneously.

5. Flying altitude, scale and resolution played a role depending on the size of the object studied or interpreted. Small forbs and some grasses were better distinguished at the larger scale while sampling of bare ground, shrubs and litter was achievable on the small scale. For many uses the less costly smaller scale photography (1:1650) would be recommended.

6. Future studies should provide for a greater correspondence between ground sampling and aerial data.

7. Large-scale aerial photography has its greatest utility on shrub-dominated rangelands where ground cover is not complete and many of the important species are distinctive and easily identified.

The results of this study are now prepared and are undergoing revision and internal review prior to submission for publication.

APPENDIX I

MINUTES

FOURTH EXECUTIVE COMMITTEE MEETING

SAVAL PROJECT

July 10, 1985

Committee Members Present:	Observers:
Mr. Edward Spang (Chairman)	H. Bisson
Dr. E. Greer Edwards	G. Evans
Dean Bernard M. Jones	G. F. Gifford
Dr. R. Duane Lloyd	G. Martinez
Dr. J. van Schilfgaarde	D. Tidwell
Mr. Jim Doughty (representing G. Thola)	B. Templeton

Dr. Peter C. Lent (Executive Secretary)

The Saval Project Executive Committee convened in Elko for its fourth meeting on July 10, following a tour of the Saval Ranch on July 9. The items of business follow below:

1. The minutes of the third Executive Committee meeting (January 8, 1985) were approved as distributed.

2. Several members commented favorably on the tour that had been provided the previous day and expressed their appreciation to all the project personnel involved with the tour.

3. It was concluded that although major changes in the scientific design and direction of the Project were contemplated, the Memorandum of Understanding, as amended and approved at the January meeting, could continue to serve as the basic agreement for the Project. Dr. Edwards agreed to return this document with his signature.

4. Dr. Edwards discussed the status of the ranch and provided some historical perspective on the current management problems. He expressed optimism that the present owners would continue to be involved and continue to cooperate with the research project.

5. It was moved and unanimously recommended by the Committee that the BLM review penalties presently outstanding against the Saval owners and see whether any action can be taken to reduce these penalties in light of the various communications problems that have apparently occurred.

6. After further discussion, D. Tidwell agreed to draft a letter for the Committee to go to the firm of John Hancock. This letter would attest to the importance of the research underway at Saval and describe the public service value of the Ranch and the sacrifices made by the owners to support the research effort.

7. The Committee developed several general guidances for a new approach to future study and research activities as part of the Saval Project:

   a. Emphasis is to be on applied research, useful to management. Make sure that applications of results are clearly identified. If they cannot be identified, do not proceed.

   b. Ability to extrapolate results to other allotments and areas was important.

   c. Future studies should be generally self-supporting and not dependent upon Saval Ranch operations to the extent possible. Small scale treatment experiments would be stressed.

   d. The long-term tie to the grazing system cycle would be dropped. The duration of any given activity or study effort needs to be individually justified based on the requirements of good research design.

   e. The concept of demonstration area needed to be secondary. Good research was the primary objective. If a demonstration function could be achieved in addition, that was good, but research design should not be compromised.

8. Some guidelines for placing priorities for proposed studies were also described:

   a. Agencies are putting high priority on improving riparian zone management techniques. The riparian areas are also of great importance to ranch operators. Thus, riparian zone studies should receive similar priority.

   b. Tests of existing monitoring procedures would be valuable contributions. Modeling techniques to improve monitoring design are also needed.

   c. Input to and use of models for research design and in the long term for management simulations is encouraged. Useful models for Great Basin cold desert rangelands are lacking.

   d. Sage grouse studies that can assist in testing and refining management guidelines should be continued.

e. Interdisciplinary studies will be stressed. One of the major rationales for continuing work at Saval is the opportunity for such research.

9. Ranch-research project relationships should be characterized as follows:

   a. The ranch will continue to follow the AMP and grazing system as agreed to until modifications, if any, are made.

   b. Close communications and cooperation with one another will still be required even though the immediate dependency of the research on ranch operations will be greatly reduced.

   c. Once the position and capability of the ranch operators improves, perhaps in a couple of years, this relationship and the study emphasis will again be reviewed by the Executive Committee.

10. The study development and review procedure was discussed. The Project Manager would convene working groups, hold meetings as necessary and prepare study proposals for review by the Executive Committee. He should make sure the proposals reflect the guidance and priorities stated above. Proposals should be prepared in time for final review at an Executive Committee meeting on December 4, 1985.

    All current activities needed to be reviewed. Any that are to be continued need to be justified. Committee review will look at each activity with regard to what it will do, that is, the application, the cost and cost effectiveness of doing it at Savel; how, when and where, breakdown of costs and support from each party, and literature reviews.

11. The need for improved publicity for the Saval Project was agreed to. The Project Manager will explore ways to improve this. Gary Evans agreed to prepare a historical perspective and review of the project and provide a draft prior to the December meeting.

12. Once again, the importance of published results was stressed. Publications should be both peer-reviewed professional journal contributions and tech-note/extension type contributions. Both are valuable and should be rewarded. Ways of rewarding productive efforts by the individual agencies and institutions were discussed, as was the possibility of shifting funds to reward productive lines of research.

13. It was agreed that the Project should again get involved in economics to look at the economic implications of various treatments or actions. This would involve modeling efforts.

Dean Jones agreed to explore ways of getting UNR involvement in this area and organize a meeting on the topics.

14. The proposed personnel actions were reviewed. A new UNR/RWF position in Elko would be created. This would be a general research assistant aide/technician position supporting all disciplines, but under the supervision of the UNR wildlife biologist in Elko. The former non-game biologist position would not be refilled. Action on the above should be initiated immediately. Action on filling the vacant Animal Science position in Elko should be deferred until after the December meeting.

15. The next meeting of the Executive Committee would be held in Reno on December 4, 1985.

MINUTES
SAVAL PROJECT EXECUTIVE COMMITTEE

December 4, 1985

Committee members present:

Mr. E. Spang, Chairman
Dean B. Jones
Mr. G. Thola (morning only)
Dr. R. D. Lloyd
Dr. J. van Schilfgaarde

Others present:

D. Tidwell, BLM
F. Gifford, UNR
R. Eckert, ARS
G. Evans, ARS
D. Rathbun, BLM (morning only)

P. Lent, Project Manager

1. The minutes of the meeting of July 10, 1985 were approved as distributed.

2. Members exchanged information about the status of the ranch ownership. It was agreed that contact should be made with the new owners as soon as the ownership was resolved at the February sale.

3. A draft of the Saval Project History was reviewed briefly and the Committee expressed their appreciation to Dr. Gary Evans for his work on this. Committee members would have until the end of the month to make any further comments and recommendations regarding the document.

4. The following decisions were made regarding the package of proposals submitted for Committee review.

   Climatology: Continue data collection and perform the proposed analyses in FY86. FY86 would be the last year for running the entire station network. Analysis of project requirements and station redundancy must be completed and to the Project Manager by September 1, 1986. K. Gebhardt has lead responsibility.

   Riparian Hydrology: Approved in concept. The general feeling was that the stated objectives were too ambitious in comparison with the available dollars and manpower. Some refining is necessary but the project should proceed. Further technical evaluation would be arranged through the Agricultural Experiment Station Process. The linkages with other studies, such as Platts' fisheries study, need to be clarified.

   Riparian Classification Tests: The project was endorsed and approved. Close coordination should be maintained with the BLM's Riparian Taskforce efforts.

   Riparian Vegetation Rootmass Study: The study was approved in principle. However, the availability of funding support from the USFS Intermountain Station was still uncertain. Close coordination with other riparian studies was considered important.

Livestock-Fisheries Interactions: Field work on this study was considered to be of high priority only if the Gance Creek site was incorporated into carefully controlled grazing experiments. If the grazing experiments do not go forward on Gance Creek then this work should be phased out. In any case close coordination with the other riparian studies was considered essential for maximum benefits and cost effectiveness.

Rangesite Soil Water Distribution: The benefits of the proposed work were not fully clear. The proposal did not stand alone well. The study should not go forward as a separate project but perhaps certain aspects or objectives could be incorporated into the Riparian Hydrology study plan or in Gebhardt's other duties.

Experimental Grazing Treatments: Several questions were raised regarding potential problems with execution of this proposed project. Dean Jones stated that he could not make a commitment on behalf of the College to accomplish this work until a new faculty mamber had been selected and was on the staff of the Animal Science Department to replace Dr. Bohman, who was retiring in 1986. It was necessary to be sure that the new faculty researcher was committed to the project and also had an opportunity to participate in the research design.

Questions were also raised about the source of livestock for these grazing trials. The following options were listed:

a. Cooperative agreement with Saval licensee
b. Pay (rental fee) for use of livestock
c. UNR lease livestock
d. Purchase livestock (through UNR)
e Contract livestock from another licensee
f. Cooperative agreement with another licensee

The preferred option would be an agreement with the new ranch owner(s) that would give the project control over the required animals for the duration of the trials. However, other options needed to be considered in detail so that we would be prepared should this preferred alternative not work out. Mr. Spang and Mr. Tidwell agreed to explore the policy questions from the BLM perspective of entering into options such as (b.) or (d.). It was agreed that year to year continuity with at least some of the cows to be used as experimental animals was essential for full scientific credibility of the project.

Questions as to the exact location and extent of the the required experimental pastures, especially in the riparian zone, were also discussed. The Executive Committeee needed to be assured that removal of such pastures from the license was feasible and that the location of the pastures could be worked out so as not to cause problems or hardships for the owners. Specifically, it needed to be ascertained if private lands were a requirement to accomplish the riparian zone experiments and, if so, what mechanisms and authorities existed to assure use of these lands on a long term basis.

The Project Manager was instructed to continue to develop details and options on these issues, discuss these details and their potential impacts

with the District Manager and District Ranger, and have a more detailed report ready for consideration in February. The project would not proceed at least until after the next meeting of the Executive Committee.

The Executive Committee also recognized the desirability of incorporating nongame wildlife studies as part of any experimental grazing research in the riparian zone. The Project Manager and Dr. Back were asked to work on a proposal in this regard.

Secondary Succession Study: The study was approved for continuation and completion according to the proposed schedule. BLM would continue to support the work but no further transfer of funds from BLM to ARS would be involved for work and expenses after April 30, 1986.

Allotment Scale Test of Monitoring Procedures: The proposal was approved. It was emphasized that the proposal was dealing with complex and sensitive subject areas. Therefore exceptionally close coordination with and among the management agencies would be important.

Sage Grouse Winter Forage Selection: It was agreed that Dr. Back should proceed with a proposal through the University to solicit outside grant funds to supplement BLM support. BLM support for this study in FY87 would be contingent upon success in obtaining such supplemental funding.

Impact of Livestock Grazing of Meadows on Sage Grouse: The proposed study was given highest priority among the sage grouse proposals. It should proceed as proposed and scheduled.

Evaluation of Flushing Counts: This proposal did not receive support as a stand-alone project. Perhaps the objectives could still be met by incorporation into the meadow grazing study. Drs. Back and Klebenow were given the option of doing so.

Sagebrush Physiological Response to Fire: As presently described the proposed study was given a very low probability of feasibility and success and thus was not approved. The possibility was left open that some objectives might be met eventually if the work were incorporated as part of a larger experimental burning proposal.

Bird Responses to Prescribed Burning: No decision was made regarding this proposal which did not involve FY86 funding.

SPUR Modelling Cooperative Efforts : It was noted that there had been some questions raised by BLM staff in the Washington office regarding the agency's overall role in this and other modelling efforts. Dr. Evans and Mr. Tidwell agreed that there needed to be a further meeting at the Washington program staff level prior to specific agreement on the Saval Project-ARS, Boise interactions.

5. It was agreed that several proposals that had been approved in principle could benefit from further peer review regarding methodology and other

technical aspects. The Project Manager was instructed to obtain further such reviews for approved projects where it seemed beneficial. Dr. Koong, Associate Director of the UNR Agricultural Experiment Station, would be able to assist with obtaining such reviews.

6. The problems in obtaining adequate vehicle support for the project in Elko were discussed. Dean Jones assured the Committee that each UNR employee on the Saval Project would have a vehicle assigned to him or her. However, he stated that he understood that federal employees and volunteers were not covered by UNR insurance and liability coverage and therefore were not authorized to drive UNR vehicles. Dr. Lent noted that the Cooperative Agreement specifically provided for such use.

7. The Committee agreed to meet again in March 1986 after the ownership of the Saval Ranch was clarified. The dates March 4-5 were tentatively set aside for that meeting.

APPENDIX II

Symbol and scientific and common names for plant species reported in current or past reports

SYMBOL	SCIENTIFIC NAME	COMMON NAME
	Tree and Shrub Species	
AMELA	*Amelanchier spp.*	Serviceberry
AMUT	*A. utahensis*	Utah serviceberry
ARTEM	*Artemisia spp.*	Sagebrush
ARLO	*A. longiloba*	Alkali sagebrush (early, low)
ARTR	*A. tridentata*	Big sagebrush
ARTRT	*A. tridentata tridentata*	Basin big sagebrush
ARTRV	*A. tridentata vaseyana*	Mountain big sagebrush
ARTRW	*A. tridentata wyomingensis*	Wyoming big sagebrush
CELA	*Ceratoides lanata*	Common winterfat
CHRYS	*Chrysothamnus spp.*	Rabbitbrush
CHNA	*C. nauseosus*	Rubber rabbitbrush
CHVI	*C. viscidiflorus*	Low Rabbitbrush
PRVI	*Prunus virginiana*	Chokecherry
PURSH	*Purshia spp.*	Bitterbrush
PUTR	*Purshia tridentata*	Antelope bitterbrush
RIBES	*Ribes spp.*	Currant, Gooseberry
RICE	*R. cereum*	Current bush
ROSE	*Rosa spp.*	Rose
SALIX	*Salix spp.*	Willow
SYMPH	*Symphoricarpos spp.*	Snowberry
TECA	*Tetradymia canescens*	Gray horsebrush
	Forb species	
ACLA	*Achillea lanulosa*	Yarrow
ALLIU	*Allium spp.*	Wild onion
ASSC	*Aster scopulorum*	Crag aster
BORAG	Boraginaceae	Borage family
CASTI	*Castilleja spp.*	Paintbrush
CHEVO	*Chenopodium spp.*	Pigweed
COLLO	*Collomia spp.*	Collomia
COMPO	Asteraceae	Composite Family
COPA	*Collinsia parviflora*	Little flower collinsia
CRAC	*Crepis acuminata*	Tapertip hawksbeard
DESCU	*Descurainia spp.*	Tansy mustard
ERIOG	*Eriogonum spp.*	Wild buckwheat
FRAGA	*Fragaria spp.*	Strawberry
GABI	*Galium bifolium*	Bedstraw
HACKE	*Hackelia spp.*	Stickweed
HYCA	*Hydrophyllum capitatum*	Cow cabbage, waterleaf
IVAX	*Iva axillaris*	Poverty sumpweed
LODI	*Lomatium dissectum*	Carrotleaf lomatium
LVCA	*Lupinus caudatus*	Tailcup Lupine

SYMBOL	SCIENTIFIC NAME	COMMON NAME
MESA	*Medicago sativa*	Ladak alfalfa
MEOF	*Melilotus officinalis*	Yellow sweetclover
MECI	*Mertensia ciliata*	Shortstyle bluebell
NAVAR	*Navarretia spp.*	Navarretia
PABR	*Paeonia brownii*	Peony
PHHO	*Phlox hoodii*	Hoods phlox
PHLO	*P. longifolia*	Longleaf phlox
PHORA	*Phoradendron spp.*	Mistletoe
PLANT	*Plantago spp.*	Plantain
POBI	*Polygonum bistortoides*	American bistort
POTEN	*Potentialla spp.*	Cinquefoil
SAMI	*Sanguisorba minor*	Small burnet
SMST	*Smilacina stellata*	Starry false solomon-seal
SPHAE	*Sphaeralcea spp.*	Globe mallow
STACH	*Stachys spp.*	Hedge nettle
VIOLA	*Viola spp.*	Violet
WYAN	*Wyethia amplexicaulis*	Mulesear wyethia

Grass and grass-like species

AGROP	*Agropyron spp.*	Wheatgrass
AGDE	*Agropryon desertorum*	Crested wheatgrass (Nordan)
AGSP	*A. spicatum*	Bluebunch Wheatgrass
AGTRY	*A. trachycaulum*	Slender wheatgrass
BROMU	*Bromus spp.*	Brome
BRCA	*B. carinatus*	Mountain brome
BRTE	*B. tectorum*	Cheatgrass brome
CAREX	*Carex spp.*	Sedge
ELEOC	*Eleochoris spp.*	Spikerush
ELYMU	*Elymus spp.*	Wildrye
ELCI	*E. cinereus*	Great basin wildrye
ELJU	*E. junceus*	Russian wildrye
FEID	*Festuca idahoensis*	Idaho fescue
HEKI	*Hesperocloa kingii*	Spike fescue
JUNCU	*Juncus spp.*	Rush
MUHLE	*Muhlenbergia spp.*	Muhly
MURI	*M. richardsonis*	Mat muhly
ORWE	*Oryzopsis webberi*	Webber ricegrass
POA	*Poa spp.*	Bluegrass
PONE	*P. nevadensis*	Nevada bluegrass
POPR	*P. pratensis*	Kentucky bluegrass
POSA	*P. sandbergii*	Sandberg bluegrass
SIHY	*Sitanion hystrix*	Bottlebrush squirreltail
STIPA	*Stipa spp.*	Needlegrass
STTH	*S. thurberiana*	Thurber needlegrass
AGTR2	*Agropyron trichophorum*	Pubescent wheatgrass
BRMA	*Bromus marginatus*	Big mountain brome
MEBU	*Melica bulbosa*	Oniongrass
ORHYH	*Oryzopsis hymenoides*	Indian ricegrass

Wildlife species reported from the ranch

MAMMALS

SCIENTIFIC NAME	COMMON NAME
Odocoileus hemionus	Mule deer
Antilocapra americana	Pronghorn antelope
Canis latrans	Coyote
Sorex merriami	Merriam shrew
S. palustris	Northern water shrew
Lepus californicus	Black-tailed jackrabbit
Lagurus curtatus	Sagebrush vole
Microtus montanus	Mountain vole
Onychomys leucogaster	Northern grasshopper mouse
Peromyscus maniculatus	Deer mouse
Perognathus parvus	Great Basin pocket mouse
Eutamius minimus	Least chipmunk

BIRDS

Branta canadensis	Canada goose
Anas platyrhynchos	Mallard
Anas acuta	Pintail
Anas strepera	Gadwall
Anas cyanoptera	Cinnamon teal
Anas carolinensis	Green-winged teal
Aythya americana	Redhead
Aythya affinis	Lesser scaup
Centrocercus urophasianus	Sage grouse
Steganopus tricolor	Wilson's phalarope
Zenaida macroura	Mourning dove
Eremopila alpestris	Horned lark
Amphispiza belli	Sage sparrow
Chondestes grammacus	Lark sparrow
Melospiza melodia	Song sparrow
Passerina amoena	Lazuli bunting
Passerella iliaca	Fox sparrow
Pipilo chlorurus	Green-tailed towhee
Pipilo erythrophthalmus	Rufous-sided towhee
Poocetes gramineus	Vesper sparrow
Spizella breweri	Brewer's sparrow
Zonotrichia leucophrys	White-crowned sparrow
Sturnella neglecta	Western meadowlark
Oreoscoptes montanus	Sage thrasher
Dendroica petechia	Yellow warbler
Troglodytes aedon	House wren
Turdus migratorius	American robin
Empidonax spp.	Empidonax flycatcher
Vireo gilvus	Warbling vireo
Colaptes cafer	Common flicker
Speotyto cunicularia	Burrowing owl
Podiceps caspicus	Eared grebe
E. wrightii	Gray flycatcher

FISH

Salmo clarki (S. c. henshawi?)	Humboldt (Lahontan) cutthroat trout

APPENDIX III

CONVERSION TABLE: ENGLISH TO METRIC UNITS

To Convert	Into:	Multiply by:
Acres	Hectares	.4047
Feet	Meters	.3048
Inches	Centimeters	2.5400
Miles	Kilometers	1.6090
Number/square mile	Number/square kilometer	.3863
Pounds	Grams	453.5924
Pounds	Kilograms	.4536
Pounds/acre	Grams/hectare	1120.8115
Pounds/acre	Kilograms/hectare	1.1208
Square feet	Square meters	.0929
Square yards	Square meters	.8361
Temperature (°F) -32	Temperature (C)	5/9
Yards	Meters	.9144
Cubic feet/second	Cubic meter/second	.0283
Cubic feet/second/square mile	Cubic meter/second/square kilometer	.0109

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